SCIENTIFIC AMERICAN

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RAPID TRANSIT BY BELT CONVEYOR.—[See page 257.]

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ESTABLISHED 1845

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NEW YORK, SATURDAY, MARCH 26th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE PRESERVATION OF THE CITY HALL PARK.

IT is a positive misfortune that the lack of a coordinated plan, coupled with the astounding rapidity with which the city has been built up, to say nothing of a total want of foresight on the part of the municipal authorities, should have robbed the metropolis of the New World of the opportunity to present those aggregations of magnificent municipal buildings, grouped about spacious and carefully-laid-out plazas and public squares, which are one of the glories of the great cities of the Old World. Such public spaces as we possess have been gradually encroached upon, and their intended vistas have been closed, and too often positively disfigured, by buildings of no architectural beauty, which have been run up apparently without any appreciation, and certainly with a total disregard, of the architectural opportunities thus presented and so ruthlessly thrown away.

Perhaps the best known of our public squares is City Hall Park, which, early in the last century, was beautified by the erection of that gem of municipal architecture, the City Hall, a building which, even at this late day, maintains its position unchallenged as the most perfect piece of work of its kind in New York, if not in the whole of the United States. For the greater part of a century this classic building was practically the sole occupant of the park; and, standing in the midst of its green lawns and surrounded, though not obscured, by an adequate growth of timber, this beautiful structure long remained as the dominating feature of what is certainly the most interesting and in some respects the most beautiful of our smaller city parks.

The first desecration of this spot occurred when the Federal government erected at the apex of the triangle that unsightly pile, which for several decades has done duty as the General Post Office; a building which not only entirely shuts out the charming view of City Hall and the Park which was formerly obtainable from Broadway, but constitutes in itself a monument to the total lack of refinement which marked the public architecture of the day in which it was built.

And now it is proposed, not only to further encroach upon the already restricted area of the park by building thereon a County Court House of colossal dimensions, but it is intended, if you please, to place this structure immediately behind the City Hall, whose just proportions and delicate beauty will be entirely dwarfed and ruined by the towering and widely overlapping façade of the building. Although it may be a palliation, it is certainly not a justification of Mayor Gaynor and the other city officials who favor this course, to state that they do so unwillingly and after a sincere endeavor to secure some other suitable site. For there is a possible, though very costly, escape from the dilemma by means of the alternative plan which originated with the architects of this city and is receiving the indorsement of the leading artistic, municipal improvement, and historical societies, to say nothing of a thoroughly unanimous public press. This proposal is that the city purchase the two blocks lying immediately to the north of the City Hall, and place the new Court House upon the land so secured, the various departments being housed in the large office and other buildings now covering this land until such time as the new Court House is ready for occupancy. As the needs of the city demand it and the funds become available, the land so acquired would be covered with other municipal buildings of a monumental character; and ultimately this group of buildings, and the City Hall Park with the present historic structure, would form an important center with landscape and architectural effects of dignity and beauty that would be commensurate with the importance of a city which is destined ultimately to become in size, wealth, and importance the leading city of the world.

In giving our hearty indorsement to this proposal, we are not unmindful of the fact that New York city has now in contemplation public works on an enormous scale involving the expenditure of vast sums of money. But we also realize that in municipal as in other affairs, conditions may occasionally arise in which sacrifice on the part of the present generation, large as it may appear at the time, may come to be regarded by posterity as but a small price to pay for the lasting benefits conferred.

The present crisis surely presents an opportunity of this very character.

THE MEYER NAVAL REORGANIZATION TO HAVE A FAIR TRIAL.

IN view of the diversity of opinion which was developed at the hearing of the House Naval Committee, that body followed, we think, the wisest course in failing to recommend any legislative action until Secretary Meyer's plan has been in operation for a sufficient length of time to prove the extent of its practical utility. As to the wisdom of some of the changes which the Secretary has made, there can be no possible difference of opinion. The institution of a separate and independent Bureau of Accounting is one of the best reforms that have been introduced into the navy for many a decade; and already at the Boston yard, where it has been for a considerable time in operation, the system has shown very satisfactory results.

We are also heartily in sympathy with the proposal of the Secretary to dispose by sale of those of our older vessels, which are so deficient in certain necessary qualifications of a modern warship as to render the expenditure of a heavy sum of money upon them for repairs and reconstruction a very doubtful policy. A few years ago England struck off the list and put up at auction over one hundred of her warships; and there is no question that her navy was the better for this very drastic pruning out of dead and decayed material.

Although the proposal to separate the work of the navy yard under the broad division of hull and material is based upon logical grounds, and would ultimately prove to have working advantages of a practical character, we think that the proposal to so separate the work is somewhat premature, and this for the reason that we have not to-day, among the engineering corps, a body of men of sufficient shop experience to qualify them for that oversight of the shops which is contemplated in Secretary Meyer's plan. If the institution of a separate department of machinery includes as an indispensable corollary the training of a certain number of the naval engineers for *permanent shore duty* as managers of the steam engineering shops of the navy yard, the success of the plan would seem more certain. In any case, we believe that until such a trained body is available, it would be advisable to continue both the steam engineering and construction shops under the management of the naval constructors.

Now that the Meyer plan is assured of a lengthy period of trial, the country may rest assured that the whole of the naval service affected by the changes will co-operate in a loyal endeavor to give the new plan such a perfectly fair trial as will serve to determine its practical utility. Therefore we greatly regret to see that a prominent New York daily paper has so far forgotten the dignity which attaches to its well-deserved reputation, as to indulge in a bitter personal attack on certain naval officers who have recently testified before the House Naval Committee, and that our contemporary has gone so far as to insinuate that because some of these officers were not in sympathy with certain features of Mr. Meyer's plan the only proper course left for them to pursue was to tender their resignations.

It is unjust and misleading for that journal to omit to state that these officers had no choice in the matter of giving testimony before the House Naval Committee, when once they had been summoned before that body; and that it was the wish of the Secretary that they should reply to the questions of the committee, unhampered by any consideration of whether their views were or were not in harmony with his own.

So far from their frank expressions of disagreement with certain phases of the Secretary's plan showing in any sense a spirit of insubordination, we rather take it to be evidence of a true moral courage, which places the highest interests of the navy above any consideration of a purely personal character.

Therefore, to insinuate, as does the New York Sun, that from these and other gentlemen in the navy, who may happen to disagree with certain parts of the Secretary's plan, it would be impossible to secure proper co-operation during the coming months of trial, is to betray a complete ignorance of that high professional spirit which pervades the United States Naval Service, and is nowhere more conspicuous than in that hard working and little appreciated body of officers, the Naval Constructors.

THE SCOTTISH SHIP CANAL.

THE British government having reviewed the various projects for a ship canal through Scotland, whereby the Forth and the Clyde can be connected, have decided that so far as naval requirements are concerned, the most favorable route is that through Lochs Lomond and Long, or as it is generally called, the "Low Level Route." Such a canal the government states would unquestionably possess some strategical value, and as they would financially assist such a scheme, the promoters of the enterprise are urged to push the matter forward in commercial interests. The government, however, stipulates that the canal shall have a floor width of 148 feet, a depth of water of 36 feet, and locks 850 feet long by 110 feet wide at the entrance, with a depth on the sill of 36 feet.

A sea-level canal was found to be impossible; for although the mean level of the sea is practically the same on the Clyde and the Forth, the level at high water is not, so that a sea-level canal would produce sharp tidal currents which would involve serious risks in navigation.

According to the designs which have already been prepared, the entrance to the canal from the North Sea would be a little distance north of Grangemouth, striking inland in a northwesterly direction, skirting Stirling on the south and running into the Forth valley, which does not attain a higher elevation than 30 to 50 feet above sea level, then passing through the haunch of Ben Lomond into the valley of Endrick. This cut would be the heaviest on the whole route, the ridge attaining a maximum height of 260 feet above sea level. But it is short. Entering Loch Lomond, the waters of which are deep enough for the largest vessels afloat, the loch is followed for 13 miles to Tarbet, where another cut is made through the neck of land, 1¾ miles wide, separating Loch Lomond from Loch Long. The latter would be entered at Arrochar, and this loch, which has a very great depth of water, is followed until tne Firth of Clyde is reached opposite the Cloch Lighthouse. The locks would be placed at either end of the canal, that on the Clyde to lift the vessel to the level of the water in Loch Lomond, which is 22 feet above the mean level of the sea, and the other at Arrochar to regain the sea level in Loch Long.

The total length of such a canal would be 51 nautical miles, of which 30 miles would be in canal and the other 21 miles in the open waters of Loch Lomond and Loch Long. The deepest cuts would be one of 191 feet near Stirling, another of 285 feet at the head of the Forth valley, and one of 142 feet between Tarbet and Arrochar. These cuts, though deep, are very short. The vessels will have to be lifted at the Forth end of the canal, 13 feet at high water and 31 feet at low water; at Arrochar the lift would be 17 and 27 feet respectively. In addition a regulating lock would be formed at the head of the Endrick valley to be used when Loch Lomond is in high flood.

Further advantages of this route are the avoidance of river deviations, only comparatively small brooks being encountered, which could be easily syphoned across the canal. Only one deviation would be necessary, that of the Endrick, which after all is only a stream. Again, the minimum of interference with the railroads will be offered. No swing bridges will be necessary and it will be possible for vessels to proceed without shortening their masts. The sharpest curve will have a radius of two miles. The construction of the canal will entail the excavation of 170,000,000 cubic yards of material, and its cost, to meet the Admiralty requirements, would approximate $120,000,000. Work would occupy seven years.

Apart from its strategical value, the canal would have distinct attractions for commercial traffic. It will offer a shorter route between America and Europe, and will avoid the dangerous passage *via* the Pentland Firth. The extent of this "North About" traffic as it is called, including the coastal traffic, is considerable, and the saving of from 100 to 500 miles in the sea journey of the transatlantic vessels, according to the situation of the European port, would be an important consideration. The aggregate of this traffic which would use the canal is 10,724,805 tons per annum, and at an average rate of 37½ cents per ton this would yield an annual revenue of about $4,021,800, which after deducting $300,000 as the annual cost of maintenance, etc., would yield about 3 per cent. on the capital for an Admiralty canal. The scheme is being actively pushed forward, and so soon as some idea of what the government would be prepared to do financially is obtained, no difficulty will be experienced in securing the necessary financial support to construct the waterway.

AERONAUTICS.

M. Ader, the Frenchman said to have flown about 1,000 feet in 1897 with his steam-propelled monoplane, the "Avion," has recently been decorated with the red ribbon of the Legion of Honor. His machine is said to have embodied the wing-warping principle since patented by the Wrights.

Proceedings have been begun in France to invalidate the Wright patent No. 342,188, of March 24, 1904, on the ground that the patent was not worked in France within three years, as must be done according to the statute. In searching for anticipations the French lawyers have discovered the English patent No. 392 of Mathew Watt Boulton, granted in 1868, which provides movable wing tips or "ailerons" for the purpose of transverse stability. In 1870 Richard Harte, another Englishman, took out a patent (No. 1469) for maintaining transverse stability by means of revolving wing tips operated by a weight.

The second annual combined aeronautic and motor boat show opened in Olympia, London (England) on March 11th. Besides numerous small models, forty to fifty aeroplanes and balloons were shown. In addition to the regular French models of Wright, Blériot, Farman and Santos Dumont, a number of British-built duplicates were shown by well-known firms, as the Humber Company, for example. In addition to these there were a number of new aeroplanes built by English inventors. Interest in aviation is very strong in England at present, and several big aviation meets are planned for the coming summer.

In preparing for a re-hearing of his case on the 19th inst., Glenn Curtiss has experimented to see how much resistance can be interposed at the ends of the planes of his biplane without causing it to swerve. He used small vertical fins, 1x2 feet in size, and found that these could be set at right angles to the line of flight for a few seconds without causing the aeroplane to swerve from a straight path and without moving the vertical rudder. As the resistance of the balancing planes which Curtiss uses is far less than is obtained in the manner just described, there can be no turning tendency produced by them, and hence no use of the vertical rudder in conjunction with them. Mr. Curtiss has also flown with the vertical rudder tied and with it loose, showing that a movement of this rudder is not required. We also learn that the Antoinette monoplane has been flown with the vertical rudder left off. With these practical demonstrations of flight without the use of the Wrights' patented combination, there seems to be little doubt that any infringement suits they may institute will be successfully defended.

On Saturday March 12th, Aviator Louis Paulhan made only a short straight-line flight of 500 to 600 feet at the Jamaica race track. The strong wind of 25 miles an hour velocity, and the few spectators, were the principal reasons. On Sunday, however, several thousand people journeyed to the track, many of them in automobiles, and despite a wind nearly as strong as that of the day before they were not disappointed. About 4:45 P. M. Paulhan started against the wind, which was blowing directly across the track. His machine rose after a run of some 75 feet and traveled diagonally across the track while ascending constantly at an angle of 15 to 20 degrees. It rose to a height of 300 feet above the trees on the opposite side of the track; then, turning around, it sped back with the wind, passed over the grand stand and, making a sharp turn, swooped suddenly to earth at the very point at which it started 8 minutes before. Paulhan's was the most thrilling exhibition of flight ever seen near New York, and it is unfortunate that a dispute with his manager has stopped any further demonstrations.

On March 1st and 2nd Mr. Henry Farman made some record flights with passengers with a new biplane. His machine was originally built for the Rheims meeting last August, but it did not fly then owing to an accident. Despite its small size and surface, it showed excellent lifting power and stability. The spread of the upper plane is 34 feet, while the lower plane is 12 or 14 feet shorter, besides having a large section cut away in the center to accommodate the propeller. Movable flaps are fitted to the back edges of extensions of the upper plane only, and the tail consists of but a single horizontal surface between the two halves of the vertical rudder. The machine is mounted upon combined runners and skids and fitted with a 50 H. P. Gnome revolving cylinder motor. On the 1st inst. Mr. Farman made a flight of over 16 minutes with Mme. Franck and another passenger, thus beating his three-person record of 10:39 made at Betheny on August 28th, 1909. The following day he again flew with two passengers and remained aloft 62 minutes, or more than four times as long as the day before. On account of its reduced surface, Farman's biplane must have lifted over 3 pounds per square foot, which is a high figure for a biplane.

ELECTRICITY.

In September of last year the Boston and Maine Railroad established a telephone train dispatching system on the line between Boston and Fitchburg, Mass. This system proved so satisfactory that the railroad is now about to equip two new divisions with telephones. One of the divisions consists of a 95-mile line, from Concord to Woodsville, N. H., and the other of a 70-mile line, from Concord to White River Junction, Vt.

In a lecture before the Engineering Society at Birmingham, Sir Oliver Lodge discussed the question of protection from lightning. He stated that the problem consisted in finding the best method of dissipating the enormous energy of the flash, but that it was not wise to get rid of the energy too quickly. A thin iron wire is considered the best lightning conductor from the electrical point of view, but it is almost impossible to protect a building from lightning unless it is completely enveloped in a metal cage. It is by no means true that a building is safe when provided with a conductor reaching up to the tallest part of the building.

Experiments made with ultra-violet light appear to show that it is more effective for sterilizing liquids than ozone. The ultra-violet light is produced by means of mercury vapor lamps, quartz tubes being used instead of glass tubes, which are placed in direct contact with the water to be purified. A French investigator, M. Victor Henri, has found that the bactericidal action varies greatly with the distance of the lamp from the bacteria. With a Cooper Hewitt lamp of 110 volts an exposure of 300 seconds at a distance of 60 centimeters was required in order to kill the bacillus coli. At a distance of 40 centimeters an exposure of 180 seconds was sufficient, and at 20 centimeters 20 seconds. The temperature appeared to have little, if any, effect, for the microbes were destroyed even when the liquid which contained them was frozen. In treating opaque liquids, such as milk, it was necessary to spread the liquid out in a thin layer. For milk the maximum thickness of layer with which the effect could be produced was one inch. Another investigator produces the ultra-violet light by means of electric discharges in a rarefied atmosphere of carbon monoxide, carbon dioxide, sulphureted hydrogen, or sulphurous acid.

An interesting description of the rural telephone lines in the Ozarks was published in a recent number of the Electrical Review and Western Electrician. Every farmer in this region, no matter how poor he is, has a telephone. The telephone lines have been installed by amateurs, and every variety of telephone is used on them. Owing to fear of lightning the connection from the pole line to the house wire is made by bending the ends of the wires and hooking them together. When a thunder storm approaches this connection is unhooked and it frequently happens that the owner forgets to re-establish connection with the main line after the storm. The lines are all grounded, making it very difficult for one party to call another. Fifty telephones to a line is considered a light load. The lines are supported on such poles as can be easily obtained, which are seldom sunk to a sufficient depth in the ground to prevent them from leaning at all angles. Trees are also used to support the lines and the branches are seldom cut away to clear the wires. However, the subscribers appear to be satisfied if only their line "talks." The subscribers usually combine to put up a switchboard in the nearest town and pay some one for attending to the calls.

A very interesting method of electroplating has been developed in England. The metal that is to be deposited is mixed in powdered form with other substances and it is merely necessary to wet the powder and rub it on the surface that is to be plated. The other ingredients are an electro-positive metal, such as zinc or magnesium, an inert substance, such as chalk, and a salt which when wet serves as an electrolyte. The following description of the process is given by the author: "The electro-positive metal constitutes the anode and the object treated the cathode, and as 'Galvanit' contains a quantity of finely powdered electro-positive metal, it makes innumerable contacts with the cathode surface and acts as so many minute anodes. These innumerable minute anodes gradually dissolve, and in dissolving set up in the liquid little local circulations of electric current. The circuits are so excessively small, so exceedingly near together, and so numerous that they cannot be separately observed, and the surface of the metal becomes the seat of innumerable concomitant voltaic and electrolytic actions. Thus the potential or stored-up energy of the elementary substances in the powder is converted into electric current, and as these currents leave the liquid they throw down from the metallic salt in solution a thick film on the cathode, and it becomes plated over with a deposit."

SCIENCE.

Prof. Lowell announces that he has discovered a new canal a thousand miles in length on Mars. The canal developed between May and September last.

It is stated that many of the library newspapers, printed twenty years ago, are disintegrating because our modern wood-pulp paper is not permanent.

The collection of Indian costumes, weapons, and utensils brought together by E. W. Lenders of Philadelphia, and valued at $30,000, has been bought by J. Pierpont Morgan and given to the American Museum of Natural History.

The astronomical clock at Hampton Court Palace has been removed for repair and repainting for the first time for nearly thirty years. The clock, which was the first of its kind in England, was made for Henry VIII in 1540. In 1880 it was brought from a shed at the palace, where it had lain for nearly half a century, and by order of the Office of Works was re-erected in the position which it has since occupied in the courtyard of the palace.

The comet discovered by Daniel in December is not the same as one discovered in 1867, for which a period of about forty-two years had been found. Daniel's comet has been found to belong to the Jupiter family of comets, having a period of about six and a half years. There are now over thirty of these, and four or five of them pass through perihelion every year; but they are in many cases so faint as to elude observation altogether.

W. W. Coblentz has discovered that one of the ingredients of the milky fluid, which the firefly (*Photimus pyralis*) exudes when touched, exhibits an intense blue fluorescence when it is exposed to ultra-violet rays. The fluorescence spectrum is very bright and continuous from 380$\mu\mu$ to 510$\mu\mu$. ($\mu\mu$, the unit in which wave lengths are measured equals 1-1,000,000 millimeter, or 1-25,000,000 inch.) The "phosphorescent" light which the firefly emits at night is orange-colored, and its spectrum extends from 510$\mu\mu$ to 670$\mu\mu$. Hence the two spectra are mutually complementary.

In the northern part of Archangel, which is the most northerly government of European Russia, a farm for the breeding of Kamschatka otters, blue foxes, sables, martens, and other valuable fur-bearing animals is being established by German capitalists. The soil and climate of this district are exactly suited to the animals and the annual rental charge is only about 5 cents per acre, so that the venture appears very promising at first glance. On the other hand, a large initial outlay is required. The farm contains 1,200 acres, is inclosed by a fence covered with sheet iron, which has cost $67,000, but the burrowing propensities of the foxes and rodents will probably make it necessary to extend this barrier underground, at a large additional expense.

F. Soddy finds that the growth of radium proceeds according to the square of the time. On the assumption that no other intermediate bodies intervene, the period of the direct parent of radium is 17,500 years. The amount of radium present in the last prepared solution is less than that to be expected; this suggests the existence of at least one new product, "Uranium A," intermediate between uranium X and the parent of radium, with a period of the order of one year. It is concluded that this would not appreciably alter the production of radium according to the square of the time over the period observations have been made, but it would vitiate the calculations of the period of the average life of the parent of radium according to the Rutherford formula.

A German bird fancier has made a series of experiments for the purpose of determining the vitality of eggs in different stages of incubation. On the fifth day of incubation five canary bird's eggs were taken from the nest, marked with numbers, and replaced in the nest, one by one, at half-hour intervals. This experiment was repeated ten times, with as many clutches of eggs. As a rule, the first three eggs replaced hatched normally and the two others failed to hatch. Hence it may be inferred that the average longevity of a canary bird's eggs, taken from the nest on the fifth day of incubation, is 1½ hours. In the same way the longevity was found to increase to 2 or 2½ hours on the seventh day, and 3½ to 4 hours on the ninth day of incubation. It was discovered by accident that eggs in a very advanced stage of incubation can endure very much longer periods of removal from the nest. Two eggs, purchased as plover's eggs, in the course of an excursion, were stowed in a basket, brought home and forgotten. On the evening of the following day a faint "peep" recalled the existence of the eggs, and it was found that a young snipe had issued from one of them. The second snipe soon made its appearance, but lived only an hour. Hence it appears that the vitality of partly hatched eggs depends on the size of the bird as well as on the stage of incubation.

An Account of a Trip in the Largest Balloon Ever Constructed

A BALLOON TRIP OF FORTY YEARS AGO.

It is doubtful whether the sensation of traveling in an airship has ever been better described than was done forty-nine years ago last June by Garrick Mallory, and published in the Philadelphia Inquirer, June 30th, 1860, after a voyage in the largest airship that had ever been constructed up to that time.

Mr. Mallory was a gentleman of education and fine descriptive talent and later commanded a brigade of cavalry during the civil war. Prof. T. S. C. Lowe, the aeronaut in charge, has a distinguished civil war record as an "aerial scout." He is constructing a great modern airship in his home city, Pasadena, Cal. Here is Mallory's account, somewhat abbreviated:

"The ascent of Mr. Lowe's mammoth airship on Thursday last was by no means an ordinary occasion. *Soi-disant* scientific aeronauts had in treatises and speeches positively demonstrated that it could not float. . . . Accordingly, when on the ground, we were beset with gratuitous advice from self-constituted professors and atmospheric voyagers, to the effect that it was madness to risk the untried experiment; and as to our friends, we were ridiculed, threatened, cajoled, bribed, and wept over by turns. . . .

"So we held a council of war with ourselves in attempted cool reason, and positively could not see why an increase of capacity in a balloon must necessarily diminish its efficiency, or that a greater range in the amount of gas to be evolved on the occasion, and in the number of sand bags to be retained or thrown away according to the object of ascent or descent, should destroy control over the element to be navigated. . . .

"The few uncut ropes are held by strong arms, the enterprising workman who seems to desire an ascent on the edge of the basket is induced to get down and put a bag of sand in his place, the other two gentlemen who determine at the eleventh hour to acquire aerial honors scramble in when the swaying has begun, the 'last dying speech and confession' has been made, all hands let go—and we are off! We don't believe it, however, in the slightest degree. There is no motion perceptible, and we ourselves are entirely stationary. Something to be sure is the matter with the field. It has dropped. Perhaps that is the reason why the crowd down below there is making such a noise. They

LOWE'S DIRIGIBLE BALLOON.
After an old newspaper print.

are frightened, most probably. To be sure, they have some reason, for it is a rather alarming occurrence for the solid earth to fall down in that way, especially when all nature is so calm, and the sun shines so happily, and our car is so nice and fixed. So we feel badly about our unfortunate fellow beings who are momentarily becoming smaller. Suddenly a brilliant idea seizes us that we have actually begun the great ascent, and we forthwith begin to wave the flags and hurrah and jump. No, we don't jump, for there isn't room; but we would if we could. The mites down below give cheer after cheer responsive, and run futilely in our course, and we fly away.

"Although nothing could have been easier than to have risen immediately to a great height, yet as the lower breeze was northerly and light, we purposely remained in it, as thereby a deliberate view of the city and its environs was presented that could not be hoped for once in a thousand times. We had precisely the day, the hour, the current, and, above all, the balloon for a bird's eye inspection of Philadelphia, so sailed calmly on, silent, and ravished with ecstasy. At the altitude of three thousand feet we look down fondly on Gray's Ferry, Darby, and the park, scenes of our equestrian pleasures, and then turn to the sparse houses of semi-rural Moyamensing, picturesquely isleted in green lakes and foliage. Next we glide on over the great city, seeming to lie asleep in that soft summer evening, with never a breath to disturb its happy rest, save the vague murmur of life which steals upward toward us, like the distant hum of invisible insects. We are higher now, and to the naked eye vast buildings like the Continental are distinguished chiefly by their known position; but as we pass along, the streets radiate on all sides with mathematical exactness, bordered with faint green lines of foliage. The public squares are patches of verdant enamel, and the spires point up at us with the beams of the sun shining from their whiteness until they only can be likened to the hoar-frost appearing on a window in winter. Far away Girard College is discerned in the distance as an anthill of marble dust, and Fairmount is found in a fairy toadstool, with the Schuylkill curving close to it like a silver thread dropped, perhaps, from the robes of Titania herself. But it is perfectly in vain to attempt any description of this most exquisite scene, which naught but the colors of the most gifted could pretend to convey to any who have not beheld it. Indeed, it was all to us but a seeming picture seen in an enraptured vision. There was no reality about it. We were real, and the car, but every-

(*Continued on page 266.*)

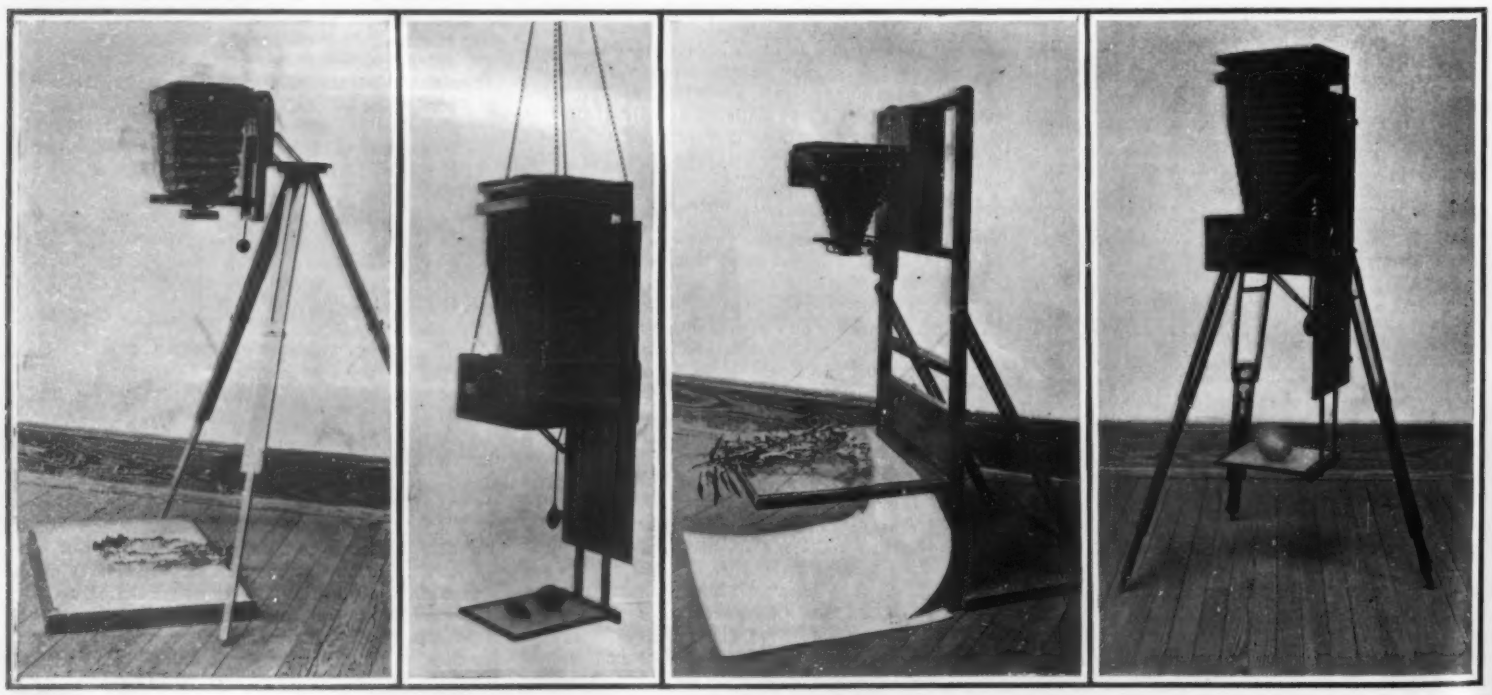
VERTICAL PHOTOGRAPHY

BY CHARLES MONROE MANSFIELD

In recording scientific material, whether plants or their fruits, or any peculiar material of which a record in picture is valuable, the exact size is always desirable. Various apparatus have been constructed to support the camera and hold the subjects, but the real secret lies in the focus of the lens. Any subject placed twice the focal length of the lens from the lens, and the ...s twice its focal length from the focal plane, will give a picture natural in size. For example, a nine-inch focus lens placed eighteen inches from the subject and the focal plane the same distance from the lens will give a natural size image in focus on the ground glass without further adjusting the camera.

Nearly all actual size work is done vertically. This gives the operator the privilege of manipulating his "under" ground during the exposure without interfering with the subject. The object to be photographed is usually placed on a glass support, which may be either plain or ground, and the back or under

(*Concluded on page 267.*)



Just an ordinary camera and tilting tripod top. The legs of the tripod may be adjusted to give the camera the needed height. The glass may be supported by four corks or a wooden frame as shown in the photograph.

The operator can revolve the entire outfit during the exposure. This gives uniform lighting and illuminates the shadows. This camera may be suspended from a tree.

This is a very simple stand for vertical photography. The camera may be moved up or down the groove in the stand and the glass frame can be regulated to any height by a worm screw on the back. This stand was made by a photographer at a very small cost.

The tripod supports are so arranged that the camera may be set up vertically. The ground glass object support is regulated by a thumb screw on the camera bed, and the bellows racked back and forth at the will of the operator. This is the same camera that is suspended from the chains.

VERTICAL PHOTOGRAPHY.

AN INTERNAL COMBUSTION WATER PUMP

THE INGENIOUS INVENTION OF H. A. HUMPHREY

Widespread interest has been aroused in European engineering circles in a new type of pump that has been evolved by a well-known English engineer, Mr. H. A. Humphrey, M. Inst, C. E. It is based upon an entirely new principle, and is a revolutionary departure from existing practice, the novelty of the design compelling as much attention as its remarkable efficiency and economy.

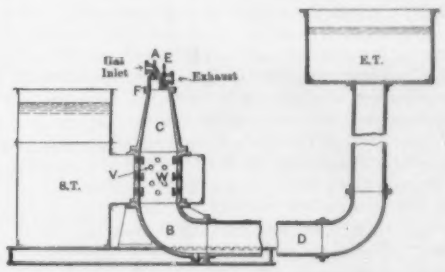
INTERNAL COMBUSTION WATER PUMP.

The pump is based on the fundamental principle of internal explosion, but does away with all the usual working parts of a gas engine, such as the piston, connecting-rod, crankshaft, flywheel, two-to-one gear cams and bearings. There are no moving parts whatever except the simple mushroom valves, which open and close automatically, due to pressure changes, and the use of a flywheel is not necessary because a column of water, forming part of the water pumped, acts as a reciprocating flywheel. The water column, which also acts as a piston, has four unequal strokes, such as theory requires when expansion is carried to atmospheric pressure. These strokes comprise long strokes during combustion and expansion as well as during exhaust, a shorter stroke during suction, and a still shorter stroke during compression. There is no valve across the discharge pipe at any point, so that the water has a perfectly free passage from the explosion chamber to the high-level tank.

The explosive mixture of gas and air is ignited, as in the ordinary internal-combustion engine, and in contact with one end of a column of water, which fulfills the dual function of piston and flywheel, and moves so as to draw in a fresh combustible charge, to compress this charge previous to explosion, to permit expansion to be carried to atmospheric pressure, and finally to exhaust the products of combustion. All these movements are brought about and controlled by changes in the momentum, which occur naturally in the column of water itself.

In order to explain the cycle of operations in a pump of the simplest type, a reference to the accompanying diagram will be found useful. The pump proper is built up from three main castings. There is the combustion chamber *C*, the water valve chamber *W*, and the bend *B*, which connects the pump to the discharge pipe *D*, leading to the elevated tank *E T*. The suction tank *S T* is extended to embrace the valve-box chamber, as shown, so that there is free access of water to all the water valves *V*. The last are plain mushroom valves, opening inward, and held on their seating by light springs. In the top of the combustion chamber is an inlet valve *A*, as well as an exhaust valve *E*. Arranged between these two valves is a simple interlocking device, so that when valve *A* has opened and closed it locks itself shut, and releases valve *E*, and when valve *E* has opened and closed it locks itself shut and releases valve *A*. Consequently, each time suction occurs in the chamber, these valves open in turn.

For the purpose of demonstration, suppose a gaseous charge is compressed in the top of the combustion chamber *C*, and is ignited in the usual manner by the sparking plug, which projects through the top casting or head of the combustion chamber. All the valves are shut at the instant the charge is exploded, and



SECTIONAL VIEW OF INTERNAL COMBUSTION PUMP.

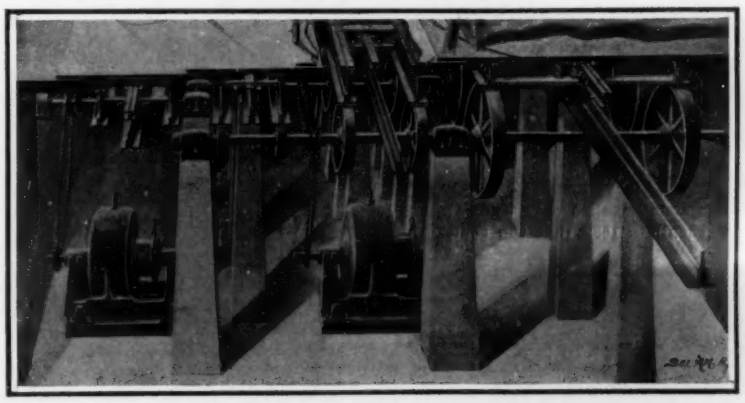
the increase in pressure resulting from the expanded gases forces the water downward in the pump, and sets the whole column of water in the bend *B* and discharge pipe *D* in motion. The column of water attains kinetic energy while work is being done upon it by the expanding gases, so that when those gases finally expand to atmospheric pressure, the column of water may be moving, say, 6 feet per second. The motion

(*Continued on page 267.*)

RAPID TRANSIT BY BELT CONVEYOR

A PROPOSED AMPLIFICATION OF NEW YORK'S SUBWAY

The method of rapid transit by means of continuously moving endless platforms has never as yet received the attention which its unquestionable advantages deserve; for, within certain limits of speed, it possesses a capacity for carrying passengers which is so far beyond that of any existing system as to place it in a class by itself. That the system has not been put into practical application in the solution of those problems of congested city traffic for which it is so admirably adapted, can only be explained by the extreme novelty of the method employed, the inertia of that deep-rooted conservatism, which, even in this strictly utilitarian age, exerts such a powerful controlling influence on human affairs. The construction and operation of the moving passenger platform is so simple, and its great carrying capacity is so obvious, that its advantages are readily perceived even by the layman who may have no particular mechanical aptitude or training; and it is certainly significant that the proposal to equip a section of the proposed New York Subway with a moving platform has received the indorsement of such men as Henry B. Seaman, the Chief Engineer of the Public Service Commission, and of Mr. L. B. Stillwell, the electrical engineer who was responsible for the electrical equipment of the Elevated Railroads and the New York Subway system. Interest in the proposed moving platform has been recently revived by the recommendation of the Board of Estimate of this city that a moving platform be installed in a subway extending across Manhattan Island from the East to the Hudson River below Thirty-fourth Street; and on the front page of the present issue is a sectional illustration, which shows the general character of the construction both of the subway and of the moving platform itself.



View of the method of driving the platforms by means of stationary electric motors and differential rubber-tired wheels.

RAPID TRANSIT BY BELT CONVEYOR.

In those branches of our industries, for the economical operation of which it is absolutely necessary that material be conveyed from place to place at a maximum speed and with a minimum cost, it has been found that there is no system of transportation which so perfectly fulfills these conditions as the belt conveyor. Particularly is this true where a great bulk of material, consisting of more or less finely divided units, such as coal, iron ore, and wheat, have to be moved in great quantities with as little interruption as possible and without any manipulation by hand. In this system, an endless belt moves continuously in a given direction; and facilities are provided for loading the material on the belt at any desired point and for unloading it therefrom at any desired point of delivery.

The moving platform is nothing more nor less than a huge belt conveyor, in which the material to be conveyed consists of the teeming millions which constitute the passenger traffic of a great city, with provision for loading the passengers at any point throughout the length of the platform and unloading them while the latter is in motion. The train consists of short jointed platforms, coupled together and forming an endless chain which is kept in continuous motion. This platform is provided with transverse seats, and it travels at a continuous uniform speed of twelve miles per hour. For transferring the passenger from the fixed station platforms to the seated platforms, there are introduced between them three narrow "loading platforms" which move at differential speeds. The first of these adjoining the station platform moves at three miles per hour, the next at six, and the next at nine miles per hour. The passenger who wishes to board the train, faces the direction in which it is moving, steps onto the three-mile-per-hour platform, and, crossing the other two successively, takes his seat. The success of the escalator or moving stairway, of which many are now in operation throughout the country, removes any doubt of passengers being able after a little practice to accommodate themselves to the speed of three miles an hour involved in boarding the train.

The advantages of the arrangement as summed up by the Chief Engineer of the Public Service Commission are as follows:

1. A vastly increased capacity, and seats for all passengers.

2. There is no delay incurred by waiting for trains at stations, as the train is always there and constantly moving.

3. Passengers may board or leave the train at any point at will, and instead of placing stations one-third of a mile apart, as on the present Subway, they may be placed at every cross street, or indeed at any intermediate point, and the construction may take the form of a continuous arcade.

In its general construction the tunnel would be similar to those built for the ordinary Subway traffic. It is proposed, however, to build arcades throughout its length, with store windows at basement level, and continuous promenades between them and the barrier separating them from the Subway platforms. At each street crossing, and if it be desired, at one or more points between them, ticket booths and turnstiles will be installed—an arrangement which would permit passengers to board the cars practically at any desired point throughout the length of the subway.

The arrangements for driving the platform by electrical power are as follows: Extending longitudinally beneath each platform is a pair of I-beams, the upper flanges of which are riveted to the bottom of the platform, while the lower flanges serve to support the weight of the platform upon pairs of wheels, which are carried upon transverse shafts mounted at intervals of 2 feet 9 inches, upon concrete piers, as shown in the engraving. Between each pair of longitudinal I-beams is carried a pair of horizontal guide wheels which engage a guide rail that serves to keep the platform in proper alignment. At every 75 feet, 10-horse-power motors are mounted on the floor of the subway, and are connected by a chain drive

(*Concluded on page 268.*)

CONDENSED FACTS ABOUT HALLEY'S COMET.

BY H. W. GRIGGS.

A few facts presented in a condensed form may possibly interest the readers of the SCIENTIFIC AMERICAN who wish to follow the course of Halley's comet in the heavens during its present appearance.

The last perihelion passage occurred on November 15th, 1835. The present perihelion passage will occur on April 20th, 1910. The perihelion distance will be 0.587, and the aphelion distance will be 35.30. The eccentricity is 0.967, the longitude of ascending node is 57 deg. 16 min., the node and apsis angle is 111 deg. 47 min., the inclination of the orbit is (162 deg. 12 min. +) 17 deg. 48 min. —, the longitude of perihelion is 305 deg. + and the motion is retrograde, in other words opposite to that of the planet. The diameter of the nucleus cannot of course be stated with anything like accuracy at the present time, but it is not likely to exceed 120,000 miles.

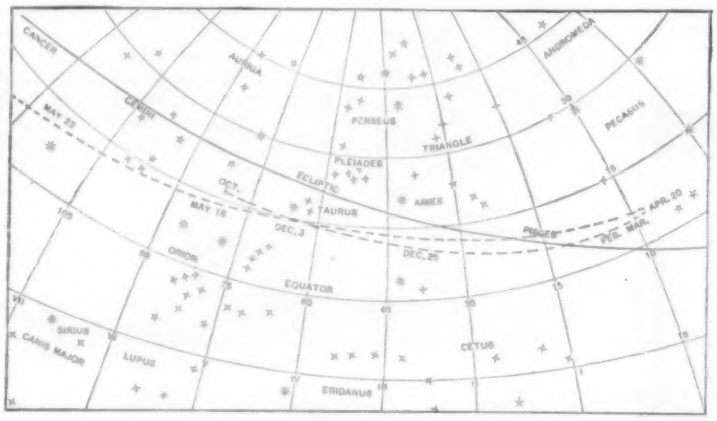
At the end of February Prof. Barnard of Yerkes Observatory estimated the tail to be 14,000,000 miles long. Just before and after perihelion passage the tail will be at least that long, and probably longer. The comet is fast approaching its perihelion point, or point nearest the sun, where, as we have said, it is due to arrive on April 20th. During the months of February and March, the earth and the comet are racing on practically parallel orbits, 170,000,000 miles apart on opposite sides of the sun.

The comet first crossed the earth's orbit about March 10th at a point where the earth will arrive at the middle of next October, but far above where the earth will be, so to speak, for it will be some 10,000,000 miles above the plane of the ecliptic. In April the comet will emerge from behind the sun, and will become visible to the naked eye in the eastern sky before sunrise.

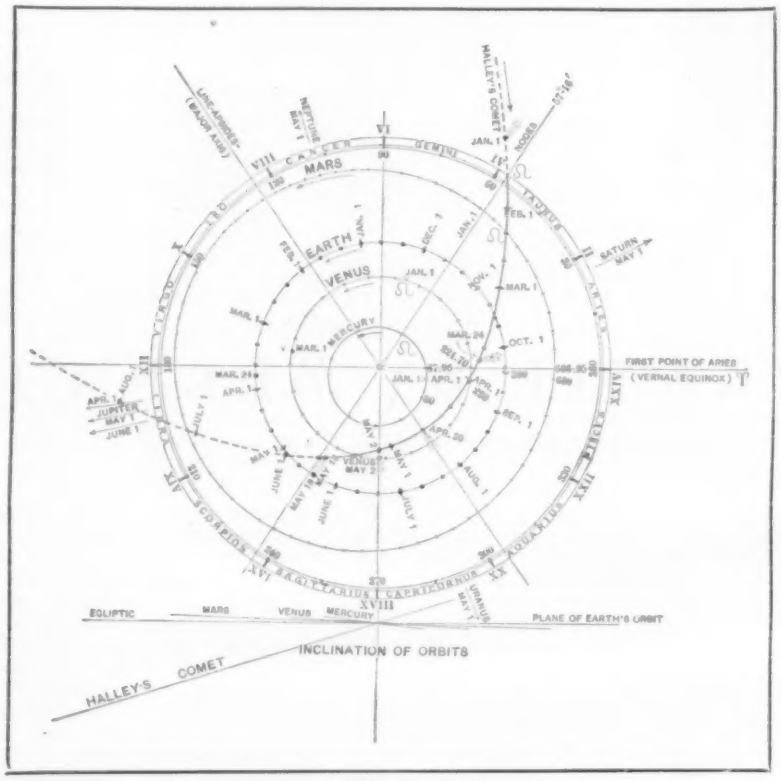
On April 20th, when the comet will swing around the sun, it will be 57,000,000 miles away from the sun. Its velocity will be 26 miles a second. The earth travels at about 19 miles a second. On May 2nd the comet will traverse the orbit of Venus, some 6,000,000 miles above the planet. In other words, an astronomer on Venus would find the comet a far more impressive spectacle than a terrestrial astronomer. As it rushes on, Halley's comet will pass between the earth and sun close to its ascending node. On May 18th the earth will be about 13,000,000 miles away from the nucleus or head, as against 5,000,000 miles in 1835. Moreover, on May 18th the earth will be enveloped in the comet's tail for a few hours. A few days later the comet will be visible in the western sky after sunset with a 15 deg. or 20 deg. splendor. After that it will speed away from the solar system. The last glimpse of it with the naked eye will be obtained probably at the end of June. It will not reappear for seventy-five years.

Halley's comet is noteworthy because it was the first comet for which an orbit was plotted and a time table calculated. It has a history more or less identified with the history of human thought and civilization. The superstitious dread with which it was regarded in medieval and ancient times swayed many a monarch. It was instrumental in forming the policies of Louis le Debonnaire in 837. It blazed in the sky when the Turks threatened to overrun Europe in 1456, and when the Reformation was at its height in 1531. It struck terror to the Saxons under Harold in 1066, when they were conquered by William of Normandy. This fear of the middle ages was dispelled only when Halley made his great prediction in 1682 that the comet would return in 1758, a prediction which was verified after the great astronomer was in his grave.

A comet which has reappeared regularly for over two thousand years must be composed of fairly enduring stuff. Just what its composition may be, the present reappearance will for the first time enable us to tell, for in 1835 the spectroscope was not invented, nor astronomical photography perfected.



THE APPARENT PATH OF HALLEY'S COMET THROUGH THE HEAVENS.



HALLEY'S COMET AND THE EARTH.

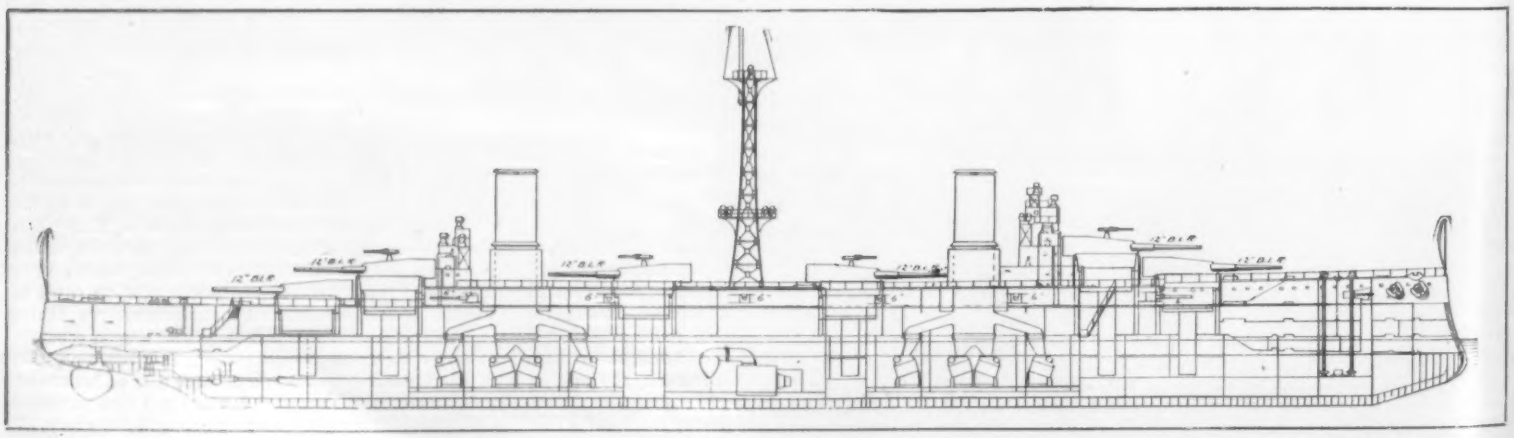
Dots on the orbits show positions of planets and comet every 10 days. Positions for January 1st, 1910, are shown thus: "Jan. 1." The ascending nodes, or points where the orbits first cross the ecliptic, are shown thus: ☊. Dotted portions of the orbits indicate the part below the ecliptic. The outer circle shows the signs of the zodiac. The celestial (heliocentric) longitude and the right ascension are indicated in hours. The Inclination Diagram shows the great angle of the comet's orbit.

THE NEW ARGENTINE DREADNOUGHTS.

Thanks to two contemporaries devoted to South American interests, La Argentina and The Standard of Buenos Ayres, we are in a position to publish some quite complete information regarding the two new dreadnoughts, contracts for which have recently been secured by the Fore River Company. Comparison will naturally be instituted between them and our latest dreadnoughts, the "Wyoming" and "Oklahoma." They are 50 feet longer, have about 3 feet more beam, about a foot less draft, and their displacement is 1,500 tons greater. The ships are as fully protected, and if expectations are fulfilled, they will have two knots greater speed, a result to which their greater length and finer lines will largely contribute. The armor plan appears to be about the same, with the addition, however, of a certain amount of special protection against under-water attack. Because of the emplacement of the two central turrets diagonally, the end-on fire, both fore and aft, will be double that of our ships; the broadside fire will be about the same.

A study of the inboard profile, for which we are indebted to La Argentina, reveals a symmetrical disposition both of the gun and motive-power weights, and one is impressed with the fact that, with the exception of the aftermost pair of guns, the battery is carried high above the water upon a lofty unbroken spar deck extending some 450 feet throughout the length of the ship. Another excellent feature is that the secondary battery is mounted entirely upon the main deck, or one deck higher than in our own "Wyoming." Hence, these guns should be capable of service in practically any weather in which an action could be carried on. The main battery is mounted in two stepped turrets forward and a similar pair aft, and in the two turrets placed *en échelon* amidships. The single military mast, built apparently of open steel trusswork, is placed exactly at the center of the ship, and below it are the engine-room compartments containing the propelling turbines. Immediately fore and aft of the engine room are the turret hoists and ammunition rooms for the central pair of turrets. Fore and aft of these are the two separate sets of boiler-room compartments; while fore and aft of these compartments, again, are the turret hoists and ammunition rooms for the forward and after pairs of turrets.

The separation of the one military mast from the neighborhood of the forward smokestack, bridges, conning tower, and forward turrets is advantageous, in-



Length, 604 feet. **Beam,** 90 feet. **Displacement,** 27,500 tons. **Belt and Turret Armor,** 12 inches. **Armament:** Twelve 12-inch, twelve 6-inch and twelve 4-inch guns. **Speed,** 22.5 knots.

SECTIONAL VIEW, SHOWING LEADING FEATURES OF THE TWO ARGENTINE DREADNOUGHTS.

	Argentina Dreadnought.	U. S. S. "Wyoming."
Length	604 feet	554 feet
Beam	96 feet	93 feet 2½ inches
Draft, normal	27 feet 6 inches	28 feet 6 inches
Displacement	27,500 tons	26,000 tons
Speed	22½ knots	20½ knots
Belt armor	12 inches	12 inches
Turret armor	12 inches	12 inches
Battery	Twelve 12-inch Twelve 6-inch Twelve 4-inch	Twelve 12-inch Twenty-one 5-inch
Fire ahead	Eight 12-inch	Four 12-inch
Fire astern	Eight 12-inch	Four 12-inch
Fire broadside	Twelve 12-inch	Twelve 12-inch

asmuch as it is thereby removed from the favorite aiming point of modern gunnery, which is a little forward of the base of the foremast.

The position of the 6-inch battery, with a protection of 8 inches of armor below and 6 inches in front of it, must be considered very satisfactory, although the protection is not equal to the 9 inches afforded to the 5-inch battery on our latest ships. Excellent also is the protection of the smokestack to a height of 15 feet above the spar deck by a special steel plate 1½ inch in thickness.

The following particulars taken from The Standard of Buenos Ayres, will be of interest: The main armor belt will extend for 250 feet in the center, and 4 feet 9 inches above and 3 feet 4 inches under the normal water line, the uniform thickness being 12 inches. The armored band will extend 75 feet toward poop and bow to the barbettes, but with the thicknes of 10 inches only. Above the principal belt of armor for the whole length of 400 feet there will be armor of 9 inches in the lower part and 8 inches in the upper part to the height of the main deck. The bow and poop will also be protected by armor of 6 and 4 inches respectively. On the main deck there will be a casemate with armor of 6 inches, in which the 6-inch guns will be placed. The bases of the chimneys will be protected to 15 feet from the deck with a special steel plate 1½ inch thick. The total weight of the armor, barbettes, turrets, etc., will be 7,000 tons. The bottom of the ship will be protected against submarine mines with 660 tons of nickel steel. The turbine engines will be in three separate and independent compartments, and the boilers will be in six compartments, divided into two groups. The capacity of the coal-bunkers is 4,000 tons and there will be tanks for 660 tons of petroleum. The turbines will develop 39,500 horse-power with 25 millimeters of pressure of air in the boilers. This, with a displacement of 27,500 tons, will give a speed of 22½ miles an hour for eight successive hours. With this speed, the radius of action will be 3,600 miles; at a speed of 15 miles the radius will be 7,200, and with 11 miles an hour 10,100 miles. The cost of each ship will be $11,000,000.

THE SCIENTIFIC AMERICAN FLYING MACHINE TROPHY.

CONDITIONS FOR 1910.

The SCIENTIFIC AMERICAN Trophy for heavier-than-air flying machines was offered by the SCIENTIFIC AMERICAN for annual competition under the rules and regulations formulated and promulgated by the Aero Club of America in 1907.

The first trial for this cup was held at Hammondsport, N. Y., on July 4th, 1908, by the Aerial Experiment Association of Hammondsport, N. Y. The minimum distance to be covered was one kilometer (3,280 feet). The trophy for 1908 was won by Glenn H. Curtiss in the "June Bug," he having made a flight of 5,090 feet. This was the first official public flight for a record made in the United States.

The trophy was also won for the year 1909 by Glenn H. Curtiss, who on July 17th fulfilled the new conditions of the competition for that year by covering a minimum distance of 25 kilometers. The actual distance covered was 25.002 miles in 52 minutes 30 seconds, which was considerably in excess of the minimum distance required.

Both of these trials were made under the supervision of the Contest Committee of the Aero Club of America.

In accordance with the deed of gift, which provides that the conditions for each contest for this trophy shall be made progressive in their severity of test in conformity with the progress of aerial navigation, the conditions to be fulfilled by the next person entitled to have his name placed on the trophy shall be a flight of not less than 40 miles across country. The contest for 1910 must be held within the United States.

RULES GOVERNING COMPETITIONS FOR THE SCIENTIFIC AMERICAN TROPHY FOR 1910.

I. The trophy is to be the property of the club and not of the members thereof, except in the event that any one person shall win the trophy three times, in which case it is to become his personal property.

Should the trophy be won by the representative of some foreign club affiliated with the Aero Club of America through membership in the International Aeronautic Federation, it shall be held in the custody of such club, but it shall be subject to competition under the same terms and conditions as if it were still held by the Aero Club of America. Should the holding club, for any reason, be disbanded, the custody of the trophy shall revert to the Aero Club of America.

Should a contest or trial under the rules not be held within a year from the date on which a foreign competing machine shall have won the trophy, the foreign aero club having possession of the cup shall give up its custody of the same and shall return the cup to the Aero Club of America, in order that the competition or trial for that year may be held in the United States of America.

The conditions under which the competitive tests and trials shall be made, shall be determined by the Contest Committee of the Aero Club of America, and such conditions shall be made progressive in their severity of test, as far as possible, in order to foster and develop the progress of the art of aerial navigation.

II. All heavier-than-air machines of any type whatever (aeroplanes, helicopters, ornithopters, etc.) shall be entitled to compete for the trophy, but all machines carrying a balloon or gas-containing envelope for purposes of support are excluded from the competition.

III. In order to compete for this prize, the contestant should file with the Aero Club of America a formal entry, addressed to the club at its headquarters in New York, declaring his intention to compete for the trophy. Whether the trial is to be made at a recognized aeroplane meeting or at a special trial, the contestant should indicate the date upon which he seeks to make a flight. He must also deposit the amount of the fare from New York to the place of trial, and return.

THE SCIENTIFIC AMERICAN FLYING MACHINE TROPHY.

A reasonable time must be allowed for the representative of the club to reach the place where the flight is to be held. If the trial is to be made within 25 miles of New York city, the amount of the fare will be defrayed by the club. In case the Contest Committee find that the place of trial is too far distant, and they are unable to arrange to have an official present, the contestant may be required to hold the trial at some convenient place mutually to be agreed upon.

IV. The person or committee having charge of the test or trial shall make careful measurements of the distance covered by the flight, and shall prepare a written report of the test or trial, which shall be delivered to the Contest Committee of the Aero Club of America, and in such report shall state fully whether in his opinion the machine can be handled with safety, and, as far as possible, he shall determine the speed attained during the flight. He shall also take into consideration the question of stability and ease of control, and he shall state in his report weather and wind conditions.

V. The flights will be made in as calm weather as possible, but the contest committee or its representative will at its discretion order the flight to begin at any time it sees fit, provided the velocity of the wind does not exceed twenty miles an hour. The machine may start by running on the ground or upon a track under its own power, but no special launching device will be permitted. There is no requirement as to the height above the ground at which the machine must fly.

VI. Complete specifications of the competing machine, giving weight, supporting surface and power of engines, together with a description of the best trial of the machine, shall be forwarded to the Contest Committee at or before the time of making entry for the contest.

VII. The trophy shall be awarded for the year 1910 to the contestant making the longest cross-country flight during the year. The distance covered must be at least 40 miles as the crow flies, or to a point 20 miles distant, returning to the point of departure.

The trophy shall not be awarded unless formal entry for the same has been lodged by the *bona fide* owner of the machine with the Contest Committee of the Aero Club of America, in accordance with the conditions elsewhere specified. The name and record of the successful contestant shall be appropriately inscribed on the trophy.

VIII. All tests and trials shall be under the official supervision and direction of the Aero Club of America, and all questions that may arise in regard to such contest or trial shall be decided by the Contest Committee of said club, and its decision in all questions of dispute shall be final, and without right of appeal to a court of law or equity.

IX. In case the Contest Committee is unable to determine which machine has made the best performance during the year 1910, it shall arrange that a competition between such machines be held, and the machine making the best performance in such test shall be awarded the trophy for the year.

X. No trial or test for the year 1911 will be allowed until the rules governing the competition for that year have been promulgated.

Correspondence.

MR. RIEDERER'S PROBLEM.

To the Editor of the SCIENTIFIC AMERICAN:

Referring to Mr. Riederer's puzzle in the SCIENTIFIC AMERICAN dated February 19th, 1910, I take the liberty of submitting what I consider to be the most orderly way of laying out this puzzle. I started with No. 1 horizontally and used all the figures up to 15. Then I took 2 and used what I could, then 3, 4, 5, 6 and 7 successively, which is about all there is to do.

1. 2. 3.	1. 4. 5.	1. 6. 7.	1. 8. 9.	1. 10. 11.
2. 4. 6.	2. 5. 7.	2. 8. 11.	2. 9. 10.	1. 12. 13.
3. 4. 7.	3. 5. 6.	3. 8. 10.	3. 9. 11.	1. 14. 15.
4. 8. 12.	4. 9. 13.	4. 10. 14.	4. 11. 15.	2. 12. 15.
5. 8. 13.	5. 9. 14.	5. 10. 15.	5. 11. 12.	2. 13. 14.
6. 8. 15.	6. 9. 12.	6. 10. 13.	6. 11. 14.	3. 12. 14.
7. 8. 14.	7. 9. 15.	7. 10. 12.	7. 11. 13.	3. 13. 15.

Waverly, Iowa. H. N. WOODFORD.

The Current Supplement.

W. P. Dreaper's excellent consideration of the artificial silk industry is concluded in the current SUPPLEMENT, No. 1786. Attention has been again directed to the possibilities of radium as a curative agent by Sir William Ramsay and Sir Lauder Brunton. For this reason an article on the subject in the current SUPPLEMENT should be read with interest. Lucien Fournier describes the freezing process which was employed in the construction of the Paris Subway. The case of Wright versus Paulhan, and some extracts from affidavits and Judge Hand's decision in the case of the Farman and Blériot aeroplanes, is concluded. H. Thurn writes on airships, wireless telegraphy, and atmospheric electricity. Most interesting is an article by T. Kume on Japanese pearl culture, in which he considers the pearl historically in Japan, mentions the Oriental bivalves which produce the best pearls, and then describes in detail the method employed by Mikimoto for the artificial culture of pearls. Some experiments on the expansion of air by heat are described. Automobilists will read with interest an article on a variable stroke gasoline motor. Prof. T. J. J. See contributes a thoughtful paper on the origin of the lunar craters, in which he endeavors to show that these wonderful craters may be explained by the impact of some sort of projectiles. W. Nernst contributes an article on general and physical chemistry in the last forty years.

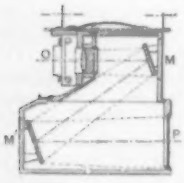
A NEW TELEPHOTO CAMERA.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

It may seem far easier than it is to construct a camera which will give an enlarged image so as to bring out the details of objects at great distances. To give a large image a long-focus lens is required, of four-foot focus for example. But a camera to use this lens must be of very great length and weight, and cannot, therefore, be said to be portable.

In the instrument illustrated, which was designed on the Vautier-Dufour and Schä system, the inventors have solved the problem of preserving the focal length of the lens, and at the same time reducing the volume and weight of the apparatus by cutting the focal length into thirds with the aid of two mirrors. At *O* is the lens which lies in the upper part of the double box. The rays passing through the lens are reflected from the upper mirror *M*, placed at the back of the box, to the mirror *M'* at the front end of the lower section, and thence to the usual ground glass *P* at the back. In this manner a camera of sixteen inches length is sufficient for a lens of four-foot focus, with an evident saving in weight and reduction of volume. Such an instrument is quite portable. The upper part of the camera is made on the extensible plan, and is drawn up and out of the lower box when the photograph is to be taken.

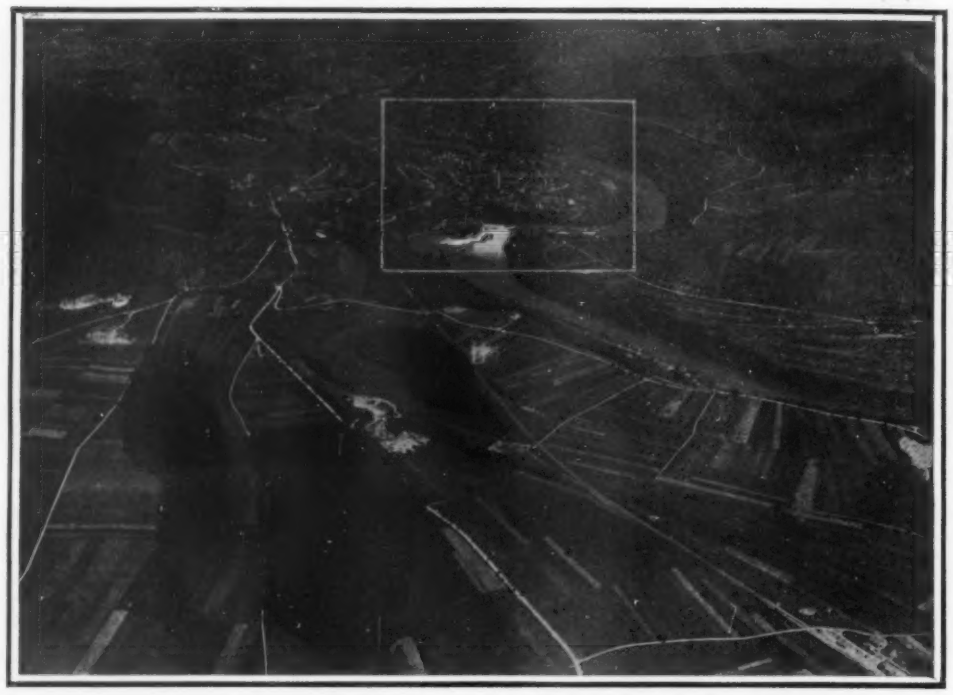
Up to the present time the different combinations of lenses for telephotography have all had one great fault, namely, a want of luminosity and consequent difficulty in focusing. It was almost impossible to use such lenses for snap shots. The camera illustrated takes instantaneous views in the usual way. The lens opening is always in ratio with the focal length of the lens, *f* 10 to *f* 12 for the extra rapid. The luminosity is thus always sufficient for instantaneous work. For the photography of inaccessible places, such as mountains or details of architecture or scenes in which the interesting spot is at a great distance from the observer, the new camera performs very good work, as will be noticed in some of the engravings presented here. In a balloon the new system renders it possible to take rapid instantaneous views which would be impossible with an ordinary teleobjective. Such views are very difficult to take, not only because of the distance of the objects, but because of the continual movement of the balloon, which makes rapid snap-shots necessary. Snap-shots can now be taken up to 1-1,000th second, which would be quite impossible with any telelens with which we are acquainted. At the full opening the present lens gives pictures which are sharp up to the edges of the plate.



O is the lens, the rays passing through the lens are reflected from the mirror M to the mirror M' and from there to the ground glass P. In this manner a camera of 16 inches in length suffices for a lens of 48 inches focus.

The present camera has already undergone trials in a free balloon on board the balloon "Mars" of the Swiss Aero Club, and the photographer took some very sharp views, which it would have been impossible to obtain with an ordinary apparatus.

Its use in field work is shown in two of the annexed views representing army maneuvers. In the first view, taken with an ordinary camera, the troops in the background can hardly be distinguished, while in the second view we clearly see the individual soldiers and can follow all their movements with ease. One of the views shows a photograph, taken on board the balloon "Mars," of the town of Neuhausen and the Rhine Falls at an altitude of 1,400 meters (4,620 feet) with an ordinary camera. The second view is taken from the same point with the new apparatus. Its use in architectural work is also seen.



The city of Neuhausen and the Rhine Falls taken with an ordinary camera.

A photograph of military maneuvers taken with an ordinary camera.

The city of Neuhausen and the Rhine Falls taken with the Vautier-Dufour camera.

A NEW TELEPHOTO CAMERA.

Why Are We Right-Handed?

BY JOHN B. HUBER, A.M., M.D.

From time to time ambidexterity is extolled as generally desirable, and there are to-day educators who consider that development of the left, coequal with that of the right hand, should be begun with the entrance of little children in our schools. It is, therefore, perhaps profitable to discuss in what manner right-handedness—by which I would here connote right-sidedness in general—has become habitual among 96 per cent of human kind; and whether ambidexterity is really desirable.

The lower animals, at least those which have not been taught tricks, use their fore paws indiscriminately; the cat strikes at a fly or plays with a mouse indifferently with either or both paws; the squirrel manipulates nuts and clings to branches quite as indifferently. Even in monkeys or gorillas, which of all animals use the fore paws mostly as hands, there is no suggestion of preferential use or superior expert-

ness in the left or the right hand, states Dr. G. M. Gould, but animals can be tutored to use one or the other paw; the dog is taught to shake hands with the right paw; the monkey to shoot manwise, with the musket butt at the right shoulder. Among microcephalic idiots, whose small-headedness is due to arrested development, left-handedness and ambidexterity have been found to reach a proportion of fifty per cent. But as we go up in the evolutionary scale of normal creatures, and as we exclude disease, we find that ambidexterity progressively gives way to single-handedness—generally right-handedness. Sir James Crichton Browne observed quite truly some years ago, that "by the superior skill of his right hand man hath gotten himself the victory" in the evolutionary struggle. To try to undo his dextral pre-eminence is to make for devolution. Glimpses of right-handedness in man, it seems, are manifest in the bronze age and in Paleolithic times. It is evident in the art of the ancients—Assyrian, Grecian, Egyptian. Historic investigation shows that all peoples, however savage, have uniformly used by preference not only one, but the same hand—the right. It is said that some races to-day manifest either-handedness; but this is in the last degree doubtful. Such statements have, for example, been made concerning the Japanese—that they are by law and practice ambidextrous. But Baron Komura has given positive assurance to the contrary. Sir James believes it doubtful whether "strictly speaking, complete ambidextry exists in any fully developed and civilized human beings, though sometimes very close approximations to it occur."

Most human beings, then, are right-handed; though, of course, there are those of great intellectuality and force who are ambidextrous, having educated themselves to this end, and are exceptional by reason of the peculiar and special training they have undergone. The origin of right-handedness will be found, I believe, to lie much deeper than the individual's voluntary selection whether he will use his right hand or his left, or whether he will be ambidextrous; the reason is to be found in human anatomy—in the position of the heart, and in the cerebral structure and organization, by which latter all voluntary movements are directed and controlled.

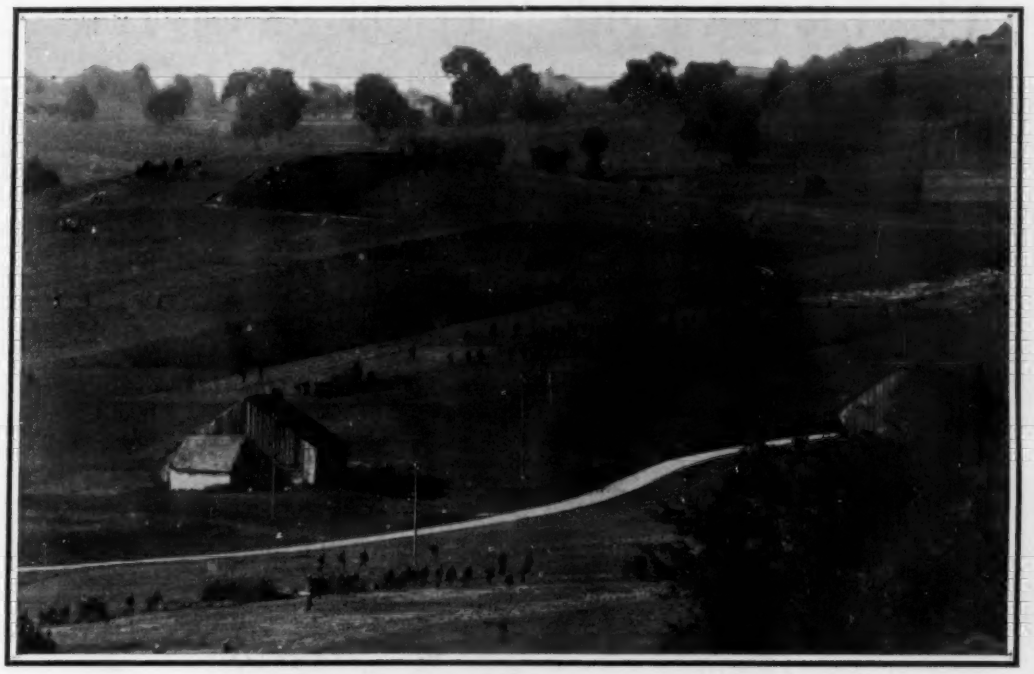
Consider in the first place how the heart and its great arteries are left-sided; though in the primordial organism from which we have evolved there was, it seems, no such symmetry. The savage, from time immemorial, has protected his heart with his left, his shield arm; but his aggressive manipulations are made with his right, his spear arm. The modern savage too, though he bears no shield — which would be useless against modern weapons — fires his musket uniformly (in a double sense) from the right shoulder, sighting with his right eye; the sword also is wielded in the right hand. These things are absolutely fixed in our military customs, and have been so throughout history.

Again, in obedience to the universal need for barter—so Dr. Gould points out—the primitive practice was counting with the low numbers, one to ten. The fingers of the free, dextral hand were first used; and all fingers are now called digits, as are the figures themselves; and the basis of our numbering is the decimal or ten-fingered system.

The second important fact in human anatomy is that all our voluntary movements are directed and controlled in the cerebral structure and organization. The brain has two hemispheres, of which the right presides, by means of certain decussating nerve fibers, over the left side of the body; while the left brain presides over the right side. And functional differences in the two sides are connected with and contingent upon differences in the two hemispheres. The left brain, in all right-handed people, is more highly developed than the right brain. It is said that this greater development of the left brain in the right-handed is so because the heart, being on the left side of the body, sends its blood with greater force and directness to the left brain. It does send the blood more directly into the left side of the neck; but the flow of blood at the base of the brain is so equalized in the "circle of Willis," that the theory here stated can hardly be accepted as conclusive. Besides, it is contradicted by the cases of left-handedness (which make up about four per cent of humanity) in which the heart is on the left side, precisely as with the right-handed.

An extremely important anatomical consideration is that in right-handed people the "speech center" is situated in Broca's convolution, in the cortex of the left frontal lobe; while in left-handed people the speech center is in the same position, but in the right frontal lobe. Now it has been found that damage to Broca's convolution in the left hemisphere deprived the right-handed man of speech, which is unimpaired in the left-handed man under the same circumstances; the left-handed man would suffer in the same way, were

(*Continued on page 268.*)

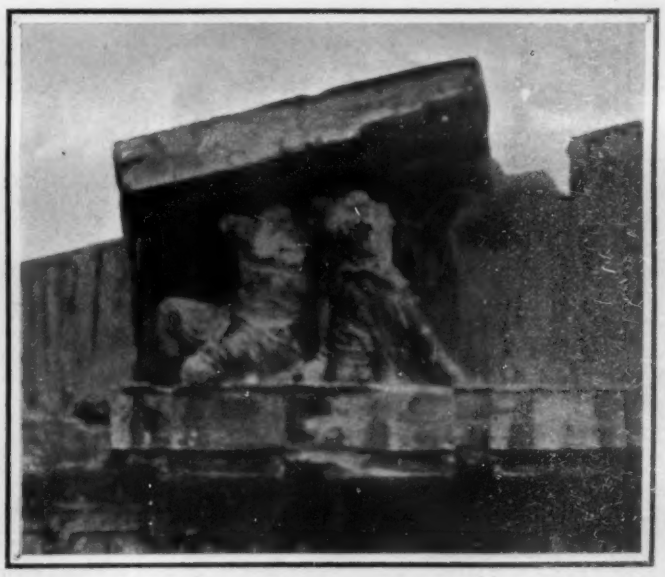


Army maneuvers taken with the Vantier-Dufour camera.

Almost indistinguishable in the quadrangle marked in the corresponding picture on page 260.

The Parthenon taken with an ordinary camera.

Detail of Parthenon taken with telephoto camera.



The effect obtained by ordinary enlargement of a detail in a photograph.

A NEW TELEPHOTO CAMERA

THERMAL TREATMENT OF STEEL INGOTS

BY J. F. SPRINGER

There are two considerable imperfections which accompany the casting of steel ingots. The more conspicuous one is that of the pipe. This is a conical cavity which forms in the upper portion. In Fig. 1 we have, in the center, two longitudinal slabs taken from steel ingots which exhibit the pipe very clearly. The usual explanation of this curious formation regards it as a consequence of contraction. A mold full of molten metal cannot be full when the ingot has cooled off. There is, in fact, a volumetric loss of perhaps 5 per cent. But this does not account for the form of the pipe. Why should it be conical? It has been suggested that perhaps contraction at the moment of solidification controls this matter. To this, however, the answer is made that gray cast iron expands at this moment, and yet it forms a pipe. Whether steel expands or contracts in the act of freezing, no one seems to know with any certainty. But steel ingots form decided pipes, as any steel makers will tell you. Prof. Howe has proposed an explanation which may help us somewhat. When the exceedingly hot steel is teemed into the mold, it finds the walls and bottom of that mold at a very low temperature, comparatively. These molds involve quite a large mass of material, as may be understood by noting the substantial character of those shown in Fig. 2. Their cooling effect is, consequently, a considerable factor. The first solid metal of this cooling ingot will constitute a shell conforming to the sides and bottom of the mold and containing a heavy mass of molten steel. Now, whether expansion or contraction takes place at the very moment of freezing, the steel of this shell will undoubtedly steadily contract. As this goes on, it meets resistance from the weight of the liquid within. Prof. Howe thinks that at times the elastic limit will be exceeded. There would thus arise a tendency to a "set," with the shell upon final cooling larger in cross section than would otherwise have been the case. Of course, the solidifying material contacting with the shell on the inside will cling to it. And further, one may conceive that, as the shell thickens, successive layers will come to normal temperature with expanded cross sections, for reasons similar to those controlling the outer shell. If so much is granted, it is easy to see that there is a tendency to leave the region of the axis empty. There is, however, another tendency at work seeking to nullify this. This is the gravitation of the fluid metal. This tends to fill up the pipe at the bottom. And so the lower portion of the ingot becomes solid throughout. But this transference of material from points above to points below impoverishes the upper portion, with the result that a pipe really forms, and that it is more extensive in cross section as one ascends.

To eliminate the pipe, many procedures have been employed. These divide themselves into the mechanical methods and thermal ones. Perhaps the most successful process which has yet found its way into commercial practice is the Harmet procedure, described in an article by the author in the Scientific American for May 29th, 1909. Methods, such as this, operate with a view of eliminating the pipe through the forcing in of its walls upon themselves while the interior of the ingot is in a liquid or plastic condition. The elaborateness of the apparatus necessary, and the length of time required, are serious considerations which operate against some, at least, of the mechanical processes. But efforts have been made to solve the problem by thermal means. If the steel at the top could be kept highly liquid until the lower part of the ingot becomes solid, then with such a reservoir perhaps the pipe could be progressively filled up as it formed. Upon some such fundamental idea the thermal processes depend. Krupp is said to have poured molten slag upon the tops of the ingots. Apparently

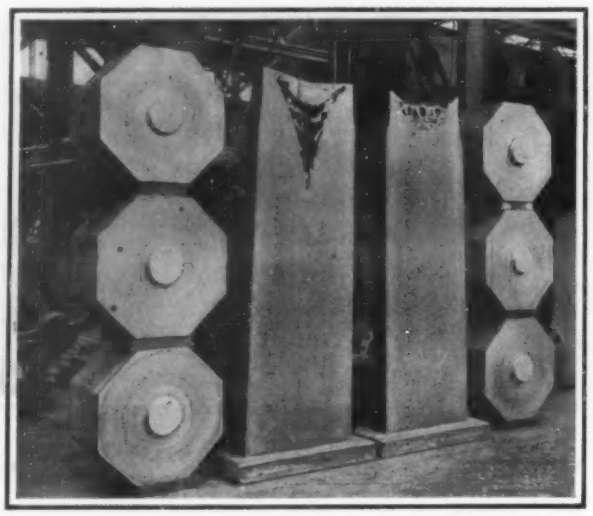


Fig. 1.—The six transverse slabs and the right-hand vertical slab were poured by the hot-top process.

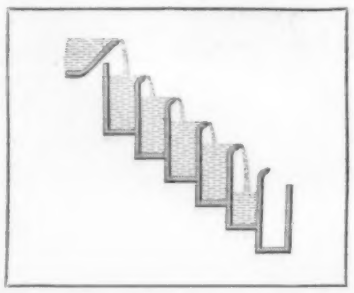


Fig. 3.—Sauveur's overflow method of pouring ingots.

but little is known of the measure of success. This might, perhaps, provide a good method. The slag would furnish considerable heat. Its lower specific gravity would prevent any mechanical penetration into the steel of the ingots. It has been found that, if ingots are cast, having a considerable taper with the large end up, the pipe will be reduced. In fact, a very considerable shortening has been accomplished in this way. Experiments have been tried where the metal was steel, zinc, and wax. All show improvement. No doubt this effect is due to the retardation of the cooling thus effected at the top by the provision there of a larger mass of metal. That is to say, the pipe is shortened if cooling is accomplished from below. There is, however, a strong objection to this method in that, although its length is reduced, the pipe is now located in the large end, and thus involves more metal in proportion to its length. Its corrective influence is thus discounted somewhat. There is another objection on the score that this method would involve complications in stripping the molds from the ingots. However, that a large source of heat at the top is of advantage is further testified to by certain experiences had with thermit. It has been found that by introducing this compound by means of a rod into the upper portion of an ingot, the pipe could be somewhat shortened. This result is, no doubt, due to the considerable heat set free upon the chemical reaction taking place between the thermit and the molten steel. The experiments with wax ingots carried out by Profs. Howe and Stoughton give evidence in the same direction. An account of these experiments may be found in an article by the present writer in the Scientific American for April 24th, 1909, where the marked difference in the length of pipe effected by casting with the big end up and the reverse is well shown by ingots Nos. 4 and 5. In the cases of ingots Nos. 6 and 7 we have the contrast realized by keeping the temperature hot at the top and cool at the bottom, and *vice versa*. The difference measured in percentage of ingot preserved from piping amounted to 48 per cent. This advantage of nearly one-half the whole ingot was in favor of the hot top. Of course, these experiments were carried out in wax, and not in steel. At the same time, they have their weight as corroborative evidence. Some years ago experiments were tried with steel by what may be called the overflow method. This is Prof. Sauveur's process. A number of molds were arranged in a way not unlike that disclosed in Fig. 3. By pouring continuously into the one on the left, all may be filled. It was thus found upon one or more occasions that the first and second ingots, whose heads were for the longest period kept hot and provided with liquid supplies of steel, disclosed no pipes. The next two had small pipes, involving about 4 or 5 per cent of the ingot length.

Now all these experiences prepare us to expect a decided success from the Riemer hot-top process as used in Germany. This inventor applies a gas furnace to the ingot top. Apparently, however, others had had a similar idea. It would seem that their processes received but inconsiderable attention. Now Riemer not only applies his furnace, but he applies it at once. Further, he provides an immense supply of heat. He thus prevents any tendency to the formation of a crust over the top. However, whether we understand why it should seem necessary to furnish heat not only in great amount but with great promptness, the fact

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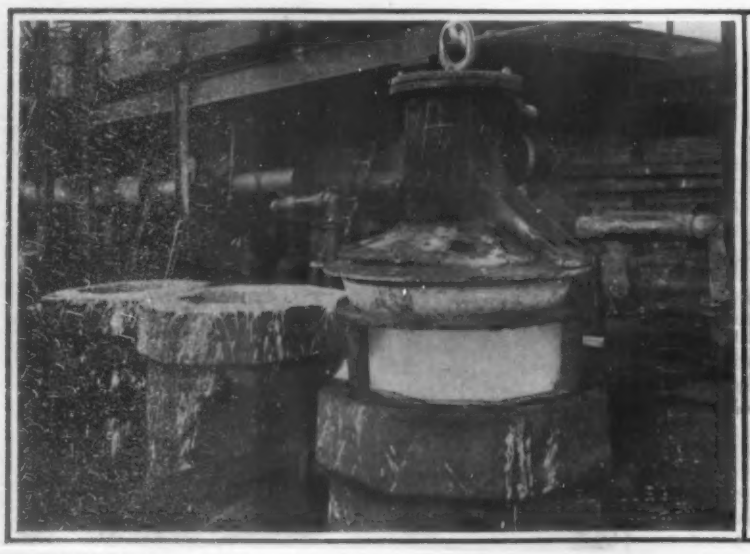

Fig. 2.—Gas furnace is here being used to pre-heat the mold before pouring the ingot.

Fig. 4.—Gas furnace in operation heating the top of a 50-ton ingot while metal is being poured into the mold.

PREVENTION OF PIPES AND SEGREGATION BY KEEPING TOP OF INGOT AT FUSION POINT DURING POURING.

EGGS OF CURIOUS FORMS

BY PERCY COLLINS

When we consider that with the exception of the class mammalia, practically every creature dwelling upon the earth at the present moment began life within the walls of an envelope popularly termed an egg, it becomes clear that the appellation must do duty for a very varied assemblage of objects. Not many people are aware that even the mammalia (or animals that suckle their young) include several egg-layers; yet such is undoubtedly the case. These strange creatures are all native of that continent of animal curiosities, namely, Australia, although two of them—the echidnas—are also found in New Guinea. These echidnas are queer ant-eater-like animals, of whose habits comparatively little seems to be known, save that they subsist mainly on insects, and that they really do lay eggs.

Much more detailed accounts are extant respecting the habits of the duck-bill. *Ornithorhynchus paradoxus* (as science terms it) is not unlike a gigantic mole in shape, save that it possesses a remarkable tail and feet and bill of duck-like design. Its habits closely resemble those of the common water rat. Frequenting the streams of southern and eastern Australia, it makes its nest in a burrow in the bank. Here Mother Duck-bill lays two white, flexible-shelled eggs, about three-quarters of an inch in length. When first hatched, the tiny duck-bills are both blind and naked, but in process of time they acquire the adult characteristic, and issue from the nest hole to feed and frolic in the river with their parents.

Leaving now the mammalia, we find that all known birds lay eggs, the largest being that of the ostrich. Many of these eggs come from Africa, and after being scratched, painted, "poker-worked," or otherwise adorned, are used for decorative purposes. Thus we are all familiar with them, and can realize that the contents of one would form a bountiful meal. But the ostrich's egg would have appeared quite small be-

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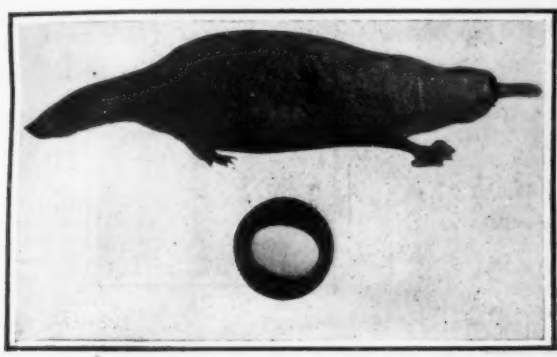
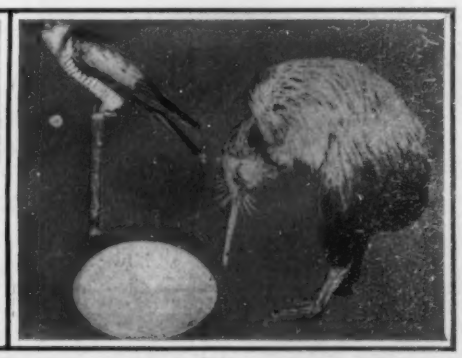
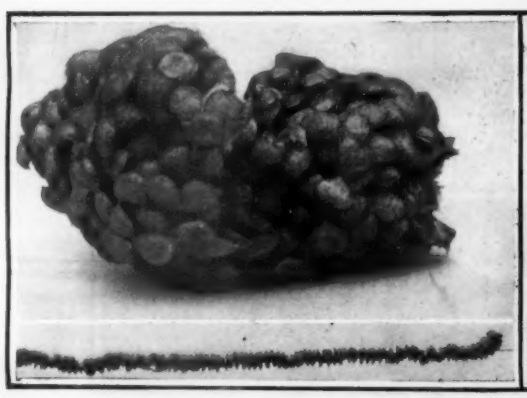


Duck-bill and egg.

Male midwife frog.



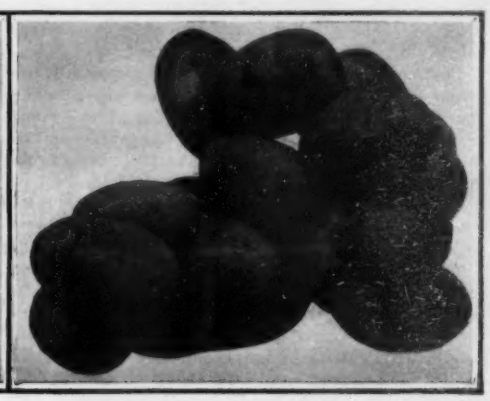
Cuckoo and its egg compared with kiwi and its egg.



1. Egg cluster of common whelk.
2. Egg-chain of turret shell.

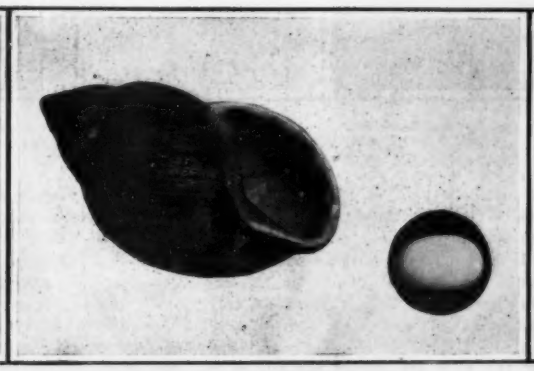
Egg-case of dog-fish.

Egg-case of hammerhead shark.



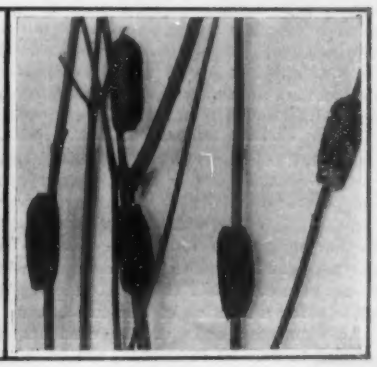
Typical cluster of snakes' eggs.

Eggs of housefly (magnified).



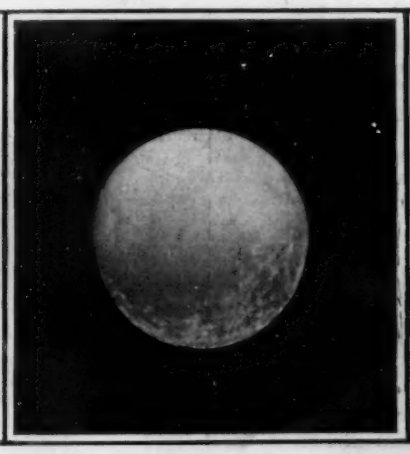
West Indian *Bulinus* shell and egg.

Eggs of a moth (magnified).



Egg clusters of *Mantis* or "rear-horse."

Eggs of parasite of hornbill (magnified).



Egg of gopher tortoise—a perfect sphere.

Egg of parasite of domestic fowl (magnified).

Egg of parasite of a bird louse (magnified).

EGGS OF CURIOUS FORMS.

CURIOSITIES OF SCIENCE AND INVENTION

MOTOR-CYCLE AUXILIARY FOR BICYCLES.

A power attachment for bicycles has recently been invented which calls for no structural alterations to be made in the ordinary bicycle and which can be attached or detached in a few minutes. The device comprises a small auxiliary wheel 20 inches in diameter fitted with a light motor which is connected to the rear wheel of the bicycle. An ingenious pivoting

A POWER ATTACHMENT FOR BICYCLES.

arrangement allows the wheel a peculiar lateral and vertical movement, so that the steering of the machine is in no way affected and permits the wheel to glide over obstacles or rough ground without transmitting any shock or vibration to the rider.

The motor is a small air-cooled, horizontal, two-stroke engine with a specially designed hub to which the power is transmitted through a six to one reducing gear. The magneto ignition and vaporizer are mounted on the same plane, and in line with the engine, so that the whole is rendered very compact.

The engine is valveless, the inlet and exhaust being governed by ports, alternately covered and uncovered by the piston. It develops 1¾ horse-power.

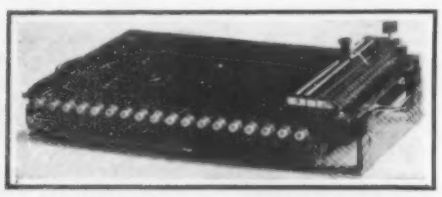
To attach the motor wheel to the ordinary cycle, it is only necessary to remove the nut of the back-wheel spindle on the chain side of the machine, and to attach the frame of the auxiliary wheel to the spindle and bolt it up—an operation occupying a few moments. A single-lever regulator controlling the motor is clipped to the handle bar, the connection with the motor mechanism being a flexible wire. This single lever controls the action of the engine to a nicety.

The wheel complete weighs only 25 pounds, and the motor is capable of driving the bicycle at an average speed of 16 miles per hour on an ordinary road, with a maximum speed of about 18 miles on the level. The fuel tank in the mud guard is of sufficient capacity to carry the motor 100 miles.

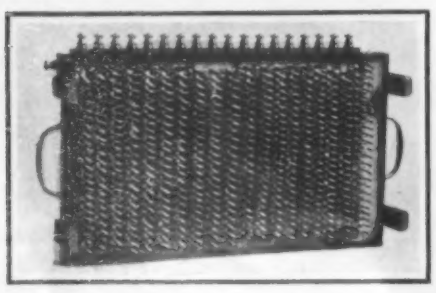
A NOVEL HIGH-POTENTIAL PRIMARY BATTERY.

A new and ingenious high-potential primary battery, the purpose of which is to supply electric charges at known potentials, was recently exhibited before the English Physical Society. The positive element of each cell consists of a small carbon rod, while a strip of pure zinc comprises the negative element, the electrolyte being a solution of calcium chloride.

The connected ends of the elements, which are mounted in parallel rows of 25, are buried in paraffin.



A HYGROSCOPIC HIGH-POTENTIAL BATTERY.



THE BATTERY INVERTED TO SHOW THE ZINC AND CARBON ELEMENTS.

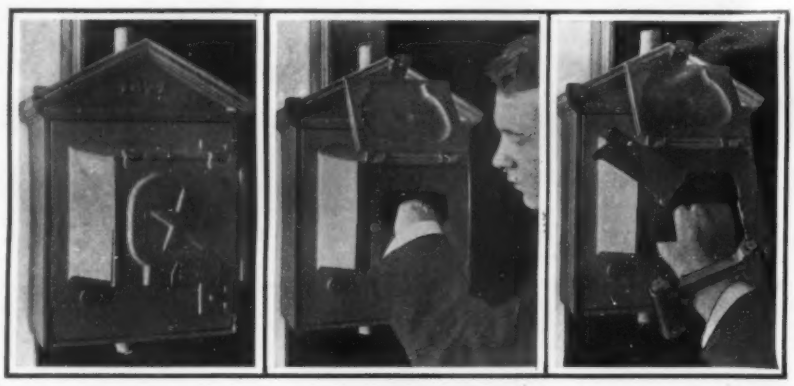
Contact between the free carbon and the zinc elements is just broken by a small pellet of paraffin, and the liquid is retained between them by capillarity.

The electrolyte comprises a saturated solution of calcium chloride which has been exposed to the air. Being hygroscopic it will absorb water until a certain equilibrium strength is obtained, this factor depending on the humidity of the air and the temperature. The electromotive force of each cell differs from one volt by only two or three per cent if exposed to very different conditions of temperature and humidity, but it has been kept steady to within 0.1 per cent for two or three consecutive days.

In conjunction with an electrostatic voltmeter, the battery is very convenient for the following purposes: In all experiments involving the use of a quadrant voltmeter, as the needle can be charged to any desired voltage up to 1,000 volts, since the battery is so designed that one or any number of elements can be taken; for the comparison and calibration of electrostatic voltmeters; for the comparison of capacities; and for the measurement of high resistances by the method of discharging a condenser through them and noting the time taken.

DETECTOR FOR FIRE-ALARM BOXES.

The problem of so designing a fire alarm box that it can be opened and operated by any one in an emergency and yet will tend to prevent the sounding of false alarms, is one that has engaged the attention of inventors for many years. A very ingenious solution of the problem is presented in the accompanying illustrations. The alarm box is closed by a cover which has to be raised as shown in one of the illustrations to permit the operator to insert his hand through an opening and release the alarm mechanism. At the moment of the release a handcuff closes over the wrist of the operator, as illustrated in another photograph. The handcuff is not chained to the alarm box; for this would make a prisoner of the operator of the alarm, whose services might be badly needed at the fire. Instead, however, the handcuff



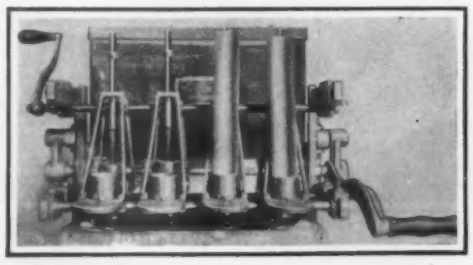
The alarm box closed. Operating the alarm. The operator handcuffed.

DETECTOR FOR FIRE-ALARM BOXES.

serves merely for identification. It is made of such form that it cannot be concealed under the coat sleeve and it betrays the sounder of the alarm to the general public, and is an honor to a man unless the alarm is a false one. Not until the fire chief has arrived with a special key to fit the handcuff may the device be removed. This system is also applicable to boxes which are locked. It frequently happens in such cases that the keys are loaned out and it is impossible to determine who sounded the alarm even when it is known whose key is missing.

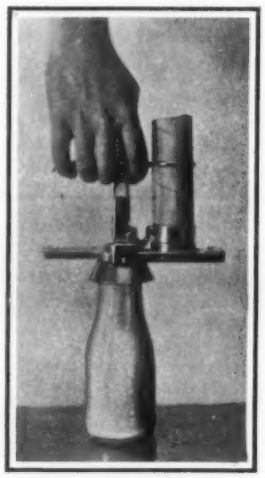
CAPPING MILK BOTTLES BY MACHINE.

Greater precautions must be taken in handling milk than any other form of food, because it is such an excellent medium for breeding germs. Hand work is always objectionable because of possible contamination from unclean fingers. Heretofore milk bottles have commonly been capped by hand. Now a simple machine has been invented for doing this work which



A MACHINE FOR CAPPING FOUR MILK BOTTLES AT A TIME.

should be of value to small as well as large dealers. The machine consists of a magazine and a means of taking one cap at a time from the magazine and pressing it firmly into place on the top of the milk bottle. It not only adds to cleanliness in dairies, but saves time, inasmuch as it is many times more rapid in the operation of capping bottles than the human



PORTABLE BOTTLE-CAPPING MACHINE.

hands. One type is portable and is operated by a quick squeeze of the handle. The other type consists of a battery of cappers which will operate to cap a number of bottles at once. The magazine takes the caps in packages from the machine which made them and obviates the necessity of handling the cap itself.

UMBRELLA SHELTER FOR AUTOMOBILES.

It is impossible to enter a vehicle on a very rainy day without getting wet, because the umbrella must be lowered before one can step inside. Surely, it is just as necessary to provide vehicles with some sort of a shelter, such as the awning of a store or the marquee of a public building. However, anything projecting from the side of a vehicle would be objectionable. The difficulty is surmounted quite cleverly in the automobile, which is illustrated in the accompanying engraving. A collapsible awning is attached to the top of the automobile, and also to the top of the door, so that when the door is opened to admit the passenger or to allow a passenger to alight, the awning will open and protect him from the rain while he is raising or lowering his umbrella. When the door is closed, the awning shuts up like a fan.

UMBRELLA SHELTER FOR AUTOMOBILES.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

ARCH SUPPORT.—P. HAMMER, Marlboro, N. Y. An object of this invention is to provide an attachment for the shoe which will comfortably support the arch or instep at all points, and will at the same time provide adequate ventilation for the interior of the shoe without admitting water from the streets in which the shoe might happen to be placed.

Of General Interest.

FOUNTAIN-PEN.—C. E. MARTLING, and C. DUNN, New York, N. Y. In this instance the aim is to provide a fountain-pen having a screw cap which forms an ink-tight joint when in position to cover the pen point, so that the ink cannot escape to any part of the holder or pen section, and in which evaporation of the ink in the barrel is prevented.

HELIOGRAPH.—T. J. MAHER, New York, N. Y. An object of the invention is to provide novel details of construction for an instrument which will reflect light rays from the sun or an artificial source, in radial lines, towards all points of the compass, and more particularly in a horizontal plane.

TREE-SPRAYER.—F. G. HAYES, Sharon, Pa. Mr. Hayes provides a light apparatus adapted to be operated from a position much lower than the usual spraying towers; provides an apparatus for directing the fluid being sprayed, which may be extended or retracted from the operating station; provides for extending and retracting the operating position of the spraying device; and provides a sprayer operable by one person.

SUPPORT FOR DISPLAY MATTER.—T. HARRINGTON, New York, N. Y. This invention is especially applicable to theatrical advertising for use in hotels, railroad stations, and other public or semi-public places in large cities, although it is evident that the invention may be employed in connection with advertisements, signs, or displays of other character or matter.

RECEPTACLE-CLOSURE.—R. G. ADAMS, Hayward, Cal. The object here is to construct the closure so that the bail and the cam member may be turned relatively to each other and to the cover and receptacle, whereby the parts may be easily and expeditiously assembled, and, further, to so construct the bail and cam member that they may be stamped from sheet metal and the cost of manufacture thus brought within the limits of practice.

MANUFACTURE OF BREAD.—C. A. HEUDEBERT, 3 Rue du Chemin de Fer, Nanterre, Seine, France. This invention relates to a novel gluten bread, very rich in nitrogenized substances produced by the incorporation of a soluble casein obtained from milk. It is of agreeable taste, such as is unattainable in the ordinary process. Mr. Heudebert has also invented a process which permits of adding the casein in large proportions to flour rich in gluten, and permits the complete incorporation of the casein, thus avoiding the formation of lumps.

Hardware and Tools.

WIRE-ROPE CLAMP.—C. A. MCCARTHY, Hattiesburg, Miss. One of the important features of this invention is the means whereby the inventor provides a practical one-bolt clamp, and in doing this he arranges grooves in close proximity to the bolt holes so that the strain of the bolt is exerted almost directly upon the cables when the latter are in the grooves, and upon the outer side of the socket receiving the bolt head he provides a square portion which forms a wrench head, so that the wrench can be put on the head and coöperate with the wrench on the nut so as to tighten the clamp upon the cables.

ATTACHMENT FOR ANVILS.—A. R. EVERETT, Brookfield Township, Ohio. The object of the invention is to provide a device which can be operatively positioned on an anvil by means of a treadle, thus obviating the necessity of the operator using his hands for this purpose, and which can be inoperatively disposed when not in use.

BUCKLE.—J. F. DUNN, New York, N. Y. In its use as a belt buckle there is a possibility of ornamentation of the exposed portion. In the present instance the body portion of the buckle is formed from a solid plate, the outer surface of which is continuous and adapted to form a surface for ornamentation, such as engravings of initials, embossing, or producing repoussé effects.

Household Utilities.

MOP AND BRUSH HOLDER.—F. DEHLING, Portland, Ore. This holder is adapted to receive and hold mops, rags, or scrubbing brushes; the holder is readily and quickly adjustable for holding articles of various sizes and characters, and is also adapted to maintain an adjustable and resilient grasp upon the article used in connection therewith.

Machines and Mechanical Devices.

METHOD FOR CASTING METAL BARS, WIRES, AND PIPES.—F. W. WINNER, Han-Yang, China. This is an improved method of casting metal bars, wires, and pipes of any length and diameter and of any cross-sectional shape, which is done by passing the metal in a molten state into a chilling mold and revolves the mold about a point, whereby the metal, after being chilled, will be assisted in its discharge from the mold by the centrifugal force developed by the revolution.

GLASS-MOLDING MACHINE.—W. J. MILLER, Coffeyville, Kan. The object here is to convert semi-automatic machines of a certain type into practically automatic machines. The invention consists in part of a pair of shears arranged at the charging position and adapted to cut off the glass as it is inserted into molds by the gatherer, the shears being actuated by the punty or pontel as the glass is placed in the mold.

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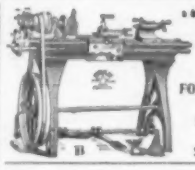

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A TRIP IN THE LARGEST BALLOON.

(*Continued from page 256.*)

thing else was a midsummer night's dream. It was only by an effort of reason, or when, through a powerful glass, we distinguished animals in motion, that we realized the home of seven hundred thousand souls to be other than a microscopically beautiful toy.

"When nearly above the office of the Inquirer, we celebrated this occasion by flying our ballast and shooting upward, which turned us more to the east, and we were above the Delaware, at an altitude of about a mile. Here we verified the fact that we could see with the naked eye the bottom of the river, and with a large spyglass clearly distinguished the great stones in its bed.

"Indeed, one of our fellow voyagers insisted upon it that he observed the motions of the fish. Certain it was that the ripple of the plying steamers was most marked, and then we turned to the shipping. . . . Having taken a patriotic squint at the Island of Smith, and the still more celebrated Tinicum, we reached the Jersey side at five minutes past six, observing Camden in all its glory. The current took us more directly toward the east, and we for half an hour or more followed closely the Camden and Atlantic Railroad, which could only be distinguished from the turnpikes by the aid of a glass. In the moving panorama, the fertile fields of East Jersey formed a most beautiful portion, with the Rancocas and Co per's .Creek winding snakelike through wee oblong inmiosures, distinguished only by the different colors of ripe wheat, growing corn, and other tokens of peace and plenty. Toward the ocean, a bank of cumulus clouds rose up, and in the west the city was growing dim. We passed over Haddonfield and near Long-a-coming and Waterford, then began to go much higher and faster, having passed right through a fleecy cloud. Beneath us stretched almost interminable pine forests, with the white sand sparkling here and there in tiny p[illegible]es. We were at this time at the highest altitude attained during the trip, about three miles, and moving to the east at the rate of at least sixty miles an hour. Here the earth appeared convex instead of concave, a phenomenon often observed and accounted for, but none the less curious, and the spirits of the party became almost as high as the barometric location of their bodies. We individually got up the ladder into the hoop and insisted on singing songs, which, owing to the rarefaction of the air and the echo from the balloon, had quite a stentorian effect. At this point, as we were far above the smoky haze surrounding the earth, and also the region of clouds, the sky looked more beautifully blue and vivid than can be conceived. The moon was almost as bright as it is usually at night, and the sun, which was nearly set to the poor people below, gave to the few clouds tints to us hitherto unknown.

"We may here mention that during the voyage we brought 'Sol' up and down several times, thus having a variety of sunrises and sunsets within the space of minutes. The atmosphere, even at our greatest elevation, was not so cold as was expected, owing to the rays of the sun being generally refracted from the hazy clouds below. The chief physical manifestation of our situation was in the ears, for when descending from a more rarefied to a denser atmosphere there was a whizzing, much like that in the diving, and from the same cause.

"Although it had been the aeronauts' intention to reach the ocean, which now was visible, the sails on it being seen by the telescope, yet a delay of two hours, occasioned by the vastness of the preparations before starting, limited the time so that it was an alternative to land on a somewhat uninhabited coast without daylight to direct us to a proper spot, or take the back track. The latter course was most prudent in reference to the securing of the balloon, and as affording

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(*Concluded from page 266.*)

better opportunities for its conveyance to Philadelphia. So we came down very fast, aided more than was entirely desired by the falling dews, and the contraction of the gas after the sun's rays had so much diminished. However, by a wholesale throwing off of ballast, we kept up at a safe distance, proceeding in a curve to the northwest, until, observing that a crowd was gathering from all points of the compass in the neighborhood of Medford, evidently calculating on our descent, and shouting loud invitations, we gratified them and promised their assistance. A large number of willing men caught hold of our long trailing rope by Mr. Lowe's direction. Our gas was allowed to escape freely, and we landed on a large sand bar, one of the best places that could have been selected, at a quarter past eight, after about sixty miles of the pleasantest voyage it is possible for man, the unwinged bird, to take."

VERTICAL PHOTOGRAPHY.

(*Concluded from page 256.*)

ground is placed under the glass supporting the article to be photographed. The distance between the support and the background varies from three inches to eighteen inches. The greater the distance the less reflection. The color of the background is generally determined by the color of the object to be photographed. When working under the subject, the light can be reflected under, rendering the background more tense, or on the subject proper, giving not only more illumination, but illumination of greater uniformity. Some subjects require a neutral ground. In this case the photographer will change his background many times during exposure. He may start out, for instance, with a pure white ground on top and remove grounds which are piled one on top of another until he passes through many shades, ending the exposure with probably a vivid red. This changing of backgrounds during an exposure will often bring out an object that would have otherwise been flat.

Cameras are manufactured especially for work of this nature and have scales of measurements so arranged that the ground glass support is part of the camera proper, but movable either way with a thumb screw, so that an allowance can be made for objects of various thicknesses. By attaching the support to the camera the camera can be swung or revolved during the exposure, giving a uniform illumination to the subject. The camera may be supported by a tripod in a vertical position, as shown in the illustration. When in the field the camera may be suspended from a tree limb.

A stand, such as shown in the illustration, may be easily made and will answer all purposes admirably. Any camera can be thus used with good results.

A tilting tripod head, which is simple in construction and inexpensive in cost, may be used in this style of photography to a good advantage. In many cases most pleasing results have been secured by this simple device. A sheet of glass for a background, a tilting top for the tripod, and the outfit is complete.

INTERNAL COMBUSTION PUMP.

(*Concluded from page 257.*)

of the column of water cannot be suddenly arrested, hence the pressure in *C* tends to fall below that of the atmosphere, and the exhaust valve *E* opens as well as the water valves *V*. Water rushes in through the water valves, mostly to follow the moving column in pipe *D*, but partly to rise in chamber *C*, in an effort to reach the same level within that chamber as in the suction tank. When the kinetic energy of the moving column gas has expended itself by forcing water into the high-level tank, it comes to rest, and, there being nothing to prevent a re-

turn flow, the column starts to move back toward the pump, and gains velocity in this movement until the water reaches the level of the exhaust valve, which it shuts by impact. The result is that a certain quantity of burnt products of combustion becomes imprisoned in the cushion space *F*, and the energy of the moving column is expended in compressing this gas cushion to a greater pressure than that due to the static head of the water in the elevated tank *E T*. Consequently, a second outward movement of the column of water takes place, and when the water reaches the level of valve *E*, the pressure in the space *F* is once more atmospheric, and further movement of the water opens valve *A* by suction against a light spring, and draws in a fresh gaseous charge. If there were no friction, the water would fall to the same level as that from which the last upward motion started; but the amount of combustible charge drawn in is slightly less than this movement would represent. Once again the column of water returns under the elevated tank pressure and compresses the charge in the combustion chamber, which is then ignited at the moment of maximum compression, and the same cycle of operations is repeated.

The ignition is timed by a small apparatus somewhat resembling an ordinary engine indicator, which closes the electric ignition circuit at the point of maximum compression, an ordinary small battery, trembler coil, and sparking plug as are used in automobile practice.

In starting the pump for the first time, compressed air is allowed to flow into the combustion chamber until the volume of air introduced is rather larger than the usual charge. The exhaust valve is then suddenly opened by means of a hand lever, and the escape of the compressed air permits a movement of the water column, which gives the cushion and suction strokes, and so draws in a fresh combustible charge, which, when the current is switched on and consequently fired, starts the pump working regularly. When the pump is stopped in the usual way in regular work, it always stops with a fresh charge of explosive mixture present in the combustion chamber, so that it is only necessary to switch on the current and the pump is started up. This enables the pump to be set in motion from the switchboard and without any preliminaries whatever.

The pump has been severely tested, and is now in regular daily work at a large pumping installation in the Midlands, giving complete satisfaction. The absence of all complicated gearing such as exists in the ordinary explosion motor is an outstanding feature, and guards the engine against breakdown, the only part that could fail being possibly a defective mushroom valve or spring. Wear and tear is also reduced to an insignificant quantity, and the troubles incidental to lubrication are overcome.

In its simplest form the apparatus converts gas power into hydraulic power, and may, therefore, be called a gas pump; but if the power is to be taken off a rotating shaft, the high-pressure water is passed through a water turbine, and so back to the apparatus to be continually circulated. The invention can also be applied with equal facility and efficiency for the compression of air.

The pump has been elaborately described by the inventor in a paper published in the Scientific American Supplement.

RAPID TRANSIT BY BELT CONVEYOR.

(*Continued from page 257.*)

with transverse shafts which carry the driving wheels of the platform. The gradation in the rate of speed of the sections of the platform is secured by varying the diameter of these driving wheels, which are 8 inches in diameter for the 3-mile, 16 inches in diameter for the 6-mile, and 24 inches in diameter for the 9-mile platform. The driving wheels are covered with rubber, as are the horizontal central guide wheels, and consequently the motion of the platform will be both smooth and silent. The successive sections are coupled together by means of links 46 inches in length, and the coupling pins are placed at the center, from which the curves of the abutting ends of the platform sections are struck; consequently, the opening between the joints may be reduced to a minimum, and a smooth surface presented for walking, with no open spaces to bewilder or trip the passenger.

The passenger-carrying capacity of the moving platform is just double the maximum capacity of the present Subway trains. According to the figures of the Public Service Commission, the total rush-hour capacity of the five-car local trains per hour is 22,500 and of the eight-car express trains 36,000, whereas the moving platform, according to their estimate, would carry 73,500 passengers per hour. They state furthermore that for all distances less than four miles the moving platform is a quicker and more convenient mode of conveyance than the present local train service and even quicker than the local and express service combined, since a passenger may reach Times Square Station, from any local station south of Fourteenth Street (that is, supposing a moving platform were installed on a north and south avenue) quicker by the moving platform than by the local and express trains of the present Subway.

In conclusion, however, we would sound a note of warning with regard to the possible interference of any moving platform subway that may be built with any future extensions of the present Subway. In selecting the route, care should be taken to choose a location where the moving platform subway will not block any of the future through lines which must ultimately be built on practically every avenue in New York city.

Why Are We Right-Handed?

(*Concluded from page 261.*)

the lesion on the right side. The hand and arm centers in the brain are intimately linked in the cortex with the speech centers. And certainly Crichton Browne is correct in the inference that the preferential use of the right hand and arms in voluntary movements is due to the leading part taken by the left brain. "We could not get rid of our right-handedness, try how we might; it is woven in the brain." And this, I believe, is the conclusion to which we must scientifically arrive. "In the curious disease *aphasia*, in which one forgets words, the lesion lies in Broca's convolution; one cannot say cup, for example, though one sees a cup; but when the right hand touches the cup, the patient at once utters its name.

Here one reflects: In the process of evolution, did the heart tend to be on the left side, and the left brain tend to greater development, because the right hand came to be the most used? Or did the right hand come to be most used, because of these heart and left-brain phenomena? I am, for my part, of the former opinion; the heart on the left side, and the greater left-brain development, are effect rather than cause, coming gradually to pass as man, in the struggle for the survival of the fittest, found right-handedness more and more advantageous.

Of course, there are professions and trades in which a certain amount of ambidexterity is essential. For example, the pianist, in playing the fugues of Bach, must produce with the left hand almost the same tones as does the right, and has to work a little harder too, for the bass notes of the piano are more thickly wired than the treble. A certain amount of ambidexterity is essential in the surgeon. Yet this gift has its disadvantages, withal; as when a colleague skilled in this way admitted to me that before doing a thing he wasted appre-

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ciable time in wondering which hand he should employ. But it is rarely really essential that such ambidexterity be acquired.

Finally, it may be objected, in favor of general education in ambidexterity: Suppose one loses his arm, and that such an unfortunate be a clerk, who must earn his living by writing. Such contingencies are almost as rare as the famous one by which Mrs. Brown justified to her husband her junk-shop purchase of a brass sign stamped "John Jones, Undertaker." "Our daughter will soon be of marriagable age; she *may* marry an undertaker whose name *may* be Jones, possibly John Jones; think how handy the sign will then be." In those rare cases of right-handed mutilation there will in time follow, through education and practice, an adequate development of the right brain, just as if the unfortunate had been left-handed.

TREATMENT OF STEEL INGOTS.

(*Concluded from page 262.*)

remains that by doing so Riemer has been able to demonstrate his success in pipe elimination on a considerable and commercial scale. A large number of steel shafts, the steel for which was made by this process and with which the discard was kept at 10 per cent or less, have successfully passed the British Board of Trade requirements. Indeed, a reference to Fig. 1 shows an ingot, treated by this method, in six transverse slabs on the right and left. The slab shown on the upper left hand came from near the top of the ingot. The longitudinal slab to the right of the center of the figure is from another ingot treated by the same hot-top procedure. The inconsiderable depth of the pipe seems pretty evident. It extends perhaps 10 per cent of the total length. But the actual percentage of steel involved is evidently much less than 10 per cent of the total.

We have in Figs. 2 and 4 two views of the gas furnace. There is an eye at the top which facilitates movement of the apparatus. Through two pipes—seen to advantage in Fig. 4—the gas and air enter. The air is under pressure. In cases where it seems desirable to do so, the furnace may be employed as a means of heating the top of the mold preparatory to teeming the steel into it. The apparatus may then be let down until its lower edge is well inside the mouth of the mold, when the pouring of the steel may be performed without removal of the furnace. There is thus ample opportunity to begin action without delay. However, it is regarded as important to have not only prompt application, but an intense heat at once. This requirement is met by preheating both gas and air. In fact, heat may be applied in such intensity as to raise the temperature of the top of the ingot above the point of fusion. It has been found unnecessary to prolong the treatment until solidification is completed. This is a favorable item, as thus the apparatus is released for other service, to which its portable character makes it applicable. In Fig. 4 the furnace is in operation heating the head of a 50-ton ingot. It will be understood that in this view the bulk of the mold is invisible. The naked flames play upon the metal at the top of the ingot. The preheating of the top of the mold tends not only to conserve the heat of the molten steels, but also to prevent heat loss by conduction from the gas flames. The furnace is being used in Fig. 2 for the purpose of preheating. However, the ingot is, in this case, said to be present.

Now in all procedure for the elimination of the pipe, we must not reach final conclusions as to their success without inquiring as to the segregation. The segregation is a locality where the steel has an excess of carbon, sulphur, phosphorus, etc., beyond the average contained in the ingot as a whole. Ordinarily, it should be removed. As it is usually located near the tail of the pipe, it may be disposed of by cropping the ingot a little below that point. However, it is well to investigate this question with some thoroughness, as the method of treatment itself may, conceivably, introduce variations from the rule. Steel of uniform composition is wanted. An ingot cast by the hot-top process was investigated as to its composition. The average carbon content should have been 0.25 per cent. By taking samples along the axis, all but one were found to contain carbon in percentages running from 0.22 per cent to 0.25 per cent. The exception was close under the tail of the pipe. Its carbon percentage was 0.41 per cent. Similar results were found for sulphur and phosphorus. Thus they existed in the segregate in percentages about three and one-half or four times what they did below it.

EGGS OF CURIOUS FORMS.

(*Continued from page 263.*)

side the extinct Madagascar bird, the Epyornis, which measured more than thirty inches in its smallest circumference.

The smallest birds' eggs are those of the minute species of humming birds, which are smaller than the eggs of certain kinds of tropical beetles. But the common cuckoo lays the relatively smallest egg. That is to say, while the jackdaw and the cuckoo are about equal in size, the former's egg is five or six times larger than the latter's. The fact that the cuckoo is wont to deposit its eggs in the nests of birds which are usually much smaller than itself doubtless accounts for this. The relatively largest egg is laid by the kiwi, a strange, wingless New Zealand bird. The egg is no less than five inches long, although the extreme length of the bird itself is only twenty-seven inches.

Reptiles' eggs are not very attractive objects. In the case of crocodiles and many kinds of tortoises they are pale-colored or white, and resemble those of birds in shape. But the egg of the gopher tortoise is remarkable for its complete roundness. It might well be mistaken for a golf ball! Many snakes' eggs are soft-skinned, brown as to color, and look for all the world like a number of new potatoes.

The eggs of fishes are usually small, soft, and inconspicuous. The most remarkable point about them is the extraordinary number laid by the individual. A single cod, for example, lays as many as nine million eggs. But a striking exception to this piscine rule of numerous inconspicuous eggs is seen among the sharks and their allies. These "tigers of the sea" lay eggs which are large in size, few as to numbers, and deposited singly instead of in masses. These eggs, of which several examples are shown in the accompanying photos, are known to fisherfolk by such names as "pixy purses," "fairy purses," or "mermaid's purses." They consist of a dark-colored, leathery envelope, and are usually adorned with frills, horns, or long twisted tendrils. These appendages serve the purpose of keeping the egg case supported among the branches of seaweeds, thus preserving the embryo from the damage it would sustain were the "purse" carried hither and thither by the waves.

Amphibians—frogs, newts, and the like—lay fish-like eggs without exception. The Surinam toad, however, has a remarkable way of dealing with the eggs when they are laid. The male takes the eggs one by one, and imbeds them in the soft skin of the female's back, each egg in a separate cell. Here the eggs remain, being carried about by the female, until the young toads hatch. There may be as many as one hundred and twenty cells in the back of a single individual, although from sixty to seventy is the more common number.

The egg-laying habits of the "midwife" frog of Europe are almost equally curious The eggs are deposited by the female in the form of long chains, which may be upward of a yard and a half in length. These chains are taken by the male and wound around his legs and

(*Concluded on page 270.*)

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Inquiry No. 9079.—Wanted, parties to make a special steel plate rolled for "angle bars," in large quantities.

Inquiry No. 9080.—Wanted the address of parties manufacturing paste-making machinery.

(*Concluded from page 269.*)

thighs. Thus equipped, he retires to a hole in the bank of the stream, where he remains in concealment until the tadpoles are on the point of hatching. Then he enters the water, when his off-spring emerge from the eggs, and wriggle away to take care of themselves.

On the seashore, after rough weather, may often be seen an object which bears no small resemblance to a cluster of purple grapes. This is a mass of cuttlefish eggs—that strange, eight-armed mollusk which disports itself in the waves to the undoing of such marine creatures as are unlucky enough to come within grasp of its suckers. Each "sea grape" is produced with a flexible stalk, by means of which it is joined to its fellows, the whole mass being fixed to some stationary object, such as a rock or stone. But like the eggs of so many marine creatures, the eggs of the cuttle are at the mercy of the elements, and in times of tempest they are often torn from their moorings, and cast bruised or broken upon the shore.

Near relatives of the cuttle are snails and shellfish of many kinds, and among this great group of animals' eggs so many strange forms are found that a description of them would fill a bulky volume. Many of the large land snails produce hard-shelled eggs, differing little in appearance from those of birds. An example is the West Indian *Bulimus*, shown in the annexed photograph, together with its white, elongated egg. But the egg cluster of the common whelk (*Buccinum*) is like a rather dingy honeycomb, partially squeezed between the hands. When the eggs are alive and healthy, the form of the young whelks can plainly be seen through the semi-transparent substance which envelops them. Another quaint form of molluscan egg is that produced by the turret shellfish (*Turritella*). The eggs are joined together like a number of small beads on a flexible cord.

If the eggs of mollusks are varied in appearance, the eggs of insects are infinitely more so. Moreover, many of them are marvelously beautiful in form and embellishment. This beauty is almost always hidden from the eye unaided by the microscope, for the eggs of most insects are mere specks, often less bulky than a grain of sand. Who, for instance, would expect to find beauty in the egg of the house fly? Yet place several of these eggs beneath a powerful lens, and a vision of beauty greets the eye. The eggs of many butterflies and moths—mere atoms laid upon a leaf—are equally attractive. In point of beauty, the egg of the moth or fly ranks far above that of the ostrich. One ponders upon this strange problem without gaining enlightenment. Why this delicate lacework? Why this flower-like elegance? Above all, why adorn at all objects of such extreme minuteness? The smaller the object, the greater the care Nature seems to lavish upon it. An example of the fact is found in the case of eggs laid by the minute insects which spend their whole lives among the feathers of birds. These minute beings pass under the unsavory title of "lice." Yet their eggs, when magnified, exhibit an amusing diversity of form and a beauty quite fairy-like. They are among the most popular of microscopic objects.

In conclusion, it may be said that certain insects deposit their eggs in clusters which bear no little resemblance to nuts or fruit. Such is the case with the "rear-horses" (*Mantidæ*) and their allies. Possibly this resemblance may be of importance in protecting these eggs from the attacks of insectivorous birds and other creatures.

Comets Expected in 1910.

The present year promises to be particularly rich in comets. Four comets, those of Winnecke, Daniel, Halley, and Inness, have been or are already visible. Inness's comet, which was very bright, appeared suddenly, it will be recalled, in the midst of a recent auroral display at Johannesburg. In addition to these four, seven periodic comets are expected to return in 1910. Probably not all of these comets will be visible, because some will be unfavorably situated with respect to the sun at the time of perihelion passage. The expected comets are the following: 1. Giacobini's comet, 1896 V. It was first thought that this comet would reach its perihelion about the middle of February, but later calculations have proved that it really passed its perihelion last December. It has not yet been seen and, as its position is very unfavorable, it may escape observation altogether. 2. Swift's comet, 1895 II. This comet was not seen at its return in 1902, and unless its orbit has been considerably changed, the conditions for its observation will be still less favorable this year. It should have passed its perihelion about the end of January, and should then have been almost exactly behind the sun. 3. The second periodic comet of Tempel should reach its perihelion about February 21st, unless its orbit has been greatly changed since 1904, when the comet was last seen. The conditions for observing this comet in its perihelion passage this year are, however, very unfavorable as, like Swift's comet, it is almost behind the sun. 4. D'Arrest's comet was seen for the first time in 1897; it was expected to return in 1904, but was not observed, owing to unfavorable conditions. This year, if its orbit is not changed, it will reach its perihelion in October. Its position then will be very favorable for observation, so that this comet will probably be visible next summer. 5. Spitaler's comet, 1890 VII, escaped detection at its visits in 1897 and 1903, because of poor conditions for observation. Dr. Hopfer, of Trieste, has shown that the orbit of this comet has been greatly altered by perturbations caused by the influence of Jupiter between 1890 and 1903. In consequence of these perturbations, the periodic time of the comet has been increased from 6.42 years to 6.82 years. The comet should pass its perihelion in October, 1910, in conditions favorable to its rediscovery. 6. Faye's comet is also expected to return in the latter part of October in conditions favorable for observation. 7. Brooks's comet, 1889 V, is expected to reach its perihelion in the summer of 1911, but it will probably be discovered during the coming summer.

Home-Made Experimental Apparatus

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A few of the many valuable articles on the making of experimental apparatus at home are given in the following list:

ELECTRIC LIGHTING FOR AMATEURS. The article tells how a small and simple experimental installation can be set up at home. **Scientific American Supplement 1551.**

AN ELECTRIC CHIME AND HOW IT MAY BE CONSTRUCTED AT HOME, is described in Scientific American Supplement 1566.

THE CONSTRUCTION OF AN ELECTRIC THERMOSTAT is explained in Scientific American Supplement 1566.

HOW TO MAKE A 100-MILE WIRELESS TELEGRAPH OUTFIT is told by A. Frederick Collins in **Scientific American Supplement 1605.**

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Good articles on **INDUCTION COILS** are contained in **Scientific American Supplements 1514, 1522, and 1527.** Full details are given so that the coils can readily be made by anyone.

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ANEROID BAROMETERS. Scientific American Supplements 1500 and 1554.

A WATER BATH. Scientific American Supplement 1464.

A CHEAP LATHE UPON WHICH MUCH VALUABLE WORK CAN BE DONE forms the subject of an article contained in **Scientific American Supplement 1562.**

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Moving Picture Royalties.

The moving-picture industry is on a distinctly theatrical basis. It has its "trust," its theaters where actors play before a camera, its scene shifters, its supernumeraries, its property men, and a whole theatrical staff more or less similar to that of the regular theater. The "trust" in question was formed about a year ago by a number of manufacturers of films under the title of the Motion Pictures Patents Company. Patents, chiefly those of Thomas A. Edison, were pooled, and active steps were taken to purge the moving-picture theater of some of the more objectionable pictures which have brought down a hail of criticism upon the industry, to license the moving-picture theater to use the apparatus and exhibit pictures, and to control the industry in general. There were many independent manufacturers who refused to pay royalties or to acknowledge the patent rights of the Motion Pictures Patents Company. A suit was recently brought by the company against Carl Laemmle, a well-known manufacturer, and the Independent Moving Picture Company of America, of which he is president, as well as the Pantograph Company, to restrain the alleged further infringement of Edison patents controlled by the Motion Pictures Patents Company. Inasmuch as the patents in question had already been adjudicated and their validity upheld, an injunction was granted.

The hearing brought out some very interesting statistics, which will undoubtedly open the eyes of the general pub-

(*Concluded on page 271.*)

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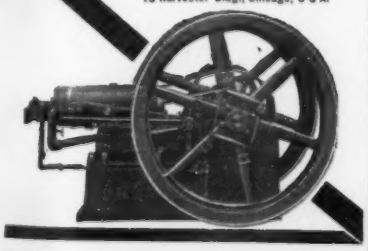

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(*Concluded from page 270.*)

lic. It seems that every day some four or five million persons attend the thirteen thousand moving-picture shows of the United States. The pictures which flicker on the screen before the spectators are projected by means of apparatus, the basic patents of which were taken out by Thomas A. Edison. These four or five million persons, therefore, unwittingly pay royalty to Mr. Edison whenever they hand in their nickels or their dimes at the box office. It is stated that about 1,440,000 feet of film are made by the members of the Motion Pictures Patents Company. On this production a royalty of half a cent per foot is paid to Mr. Edison, so that his revenue from the moving-picture-loving public amounts to $7,200 per week.

The action was brought by the Motion Pictures Patents Company to restrain infringement, but the defense set up was that the company violated the Sherman anti-trust law. The decision handed down by Judge Noyes of the United States Circuit Court was that the question at issue was patent infringement and not violation of the anti-trust law, for which reason he granted the injunction.

The Brennan Mono-rail Car.

A successful demonstration was given recently at New Brompton, of the Brennan mono-rail car. At the trial an 80-horse-power generating set was working. The trials commenced with running the vehicle, loaded with packing-cases, round the circular track of 105 feet radius at a speed approaching 20 miles an hour. The stability of the car under these conditions was apparently all that could be wished, the vehicle canting over several degrees toward the center of the circle of track. This demonstration was followed by an exhibition of the facilities afforded by such a car for unloading. The vehicle was intentionally tilted over on to chocks on the right-hand side and some cases unloaded. It was then righted and then tilted over toward the left side, and other cases unloaded, being finally righted again, all these operations of tilting and righting being performed solely with the assistance of the gyroscope gear. The next trial consisted in carrying passengers round the circular track. About fifty passengers were taken at a time, and several complete circuits of the one-eighth of a mile track were made with each load. During these runs we timed several rounds at speeds of between 18 and 20 miles an hour. The motion on board was quite pleasant, the vehicle riding very well. The inward cant that the vehicle acquires when traveling on curves at high speed naturally added to, rather than detracted from, the comfort of the passengers. Altogether some 300 persons had an opportunity of being on the carriages under these novel conditions. The demonstration which followed showed the ability of the vehicle to take sharp curves, this, however, revealing nothing more than was evident from the earlier trial toward the close of last year. The carriage, with passengers on board, was then run backward and forward at as high a speed as was practicable along the straight with perfect success. The slight lateral swaying under these conditions was quite easy, and free from jerks and jolts, and not at all unpleasant. The oscillation is of very small amplitude, as the controlling action of the gyroscopes quickly damps out any tendency to a larger movement.—Engineering (London).

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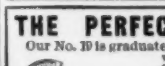

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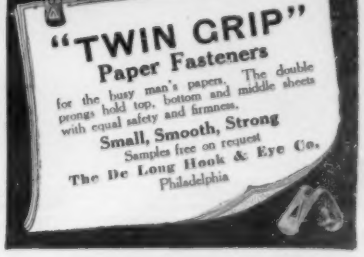

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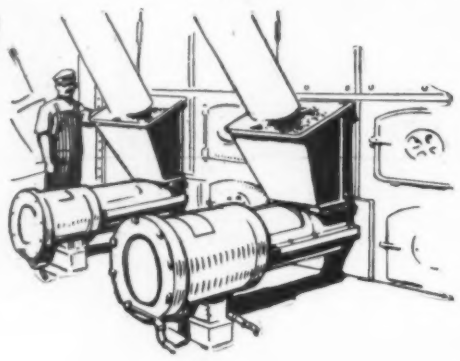

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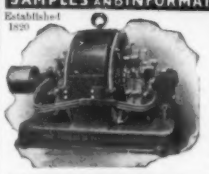

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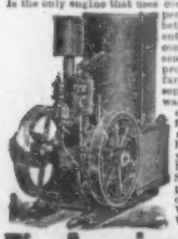

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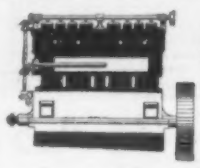

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